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INTERNATIONAL AEROLOGICAL SOUNDINGS AT ROYAL CENTER, IND., MAY, 1926

PART I. INTRODUCTION

By W. R. GREGG

Meteorologists generally will be glad to learn of the resumption of sounding-balloon observations in the United States. Several series were made prior to 1915, some of these being at St. Louis, Mo., by the Blue Hill Observatory and others at Omaha, Nebr., Huron, S. Dak., Indianapolis, Ind., and Avalon, Calif., by the Weather Bureau. Much valuable information was obtained in these series, but there are still lacking certain data which would be most useful both in theoretical and practical meteorology. For example, the characteristics of the atmosphere at great heights above anticyclones and cyclones in this country are not known in any great detail. There is reason to believe that they differ in important respects from those in Europe, but more data are needed to establish these differences. Other questions concerning which comparatively little is known at these extreme upper levels are the seasonal, latitudinal, and diurnal variations of the different meteorological elements.

The series at Royal Center, Ind., during May, 1926, is the first of what is hoped to be a large number, each one covering a month or more, and some of them consisting of simultaneous soundings from several points, for the purpose of investigating conditions at wide intervals of latitude or in different parts of high and low pressure systems.

In general these series are planned in accordance with the program of the International Commission for the Exploration of the Upper Air, formerly known as the International Commission for Scientific Aeronautics. Prior to 1925 it was the custom of this commission to select certain isolated days, usually one in each month, but in some cases three, and in one month each year a group of six days in succession. At the April, 1925, meeting of the commission the Weather Bureau proposed that all effort be concentrated in one month each year. In this way, at the end of 12 years, there would be as much observational material as under the previous plan, the entire year would be covered (assuming a different month were selected for each of the 12 years) and, most important of all, these data would give information regarding day-to-day changes almost entirely lacking now. This proposal was adopted, not as a substitute but as an addition to the previous program, and May, 1926, was named as the first "international month."

In addition to the work with sounding balloons during this month, the Weather Bureau collected a large amount of observational material regarding upper clouds. A study of these data will be published at a later time.

Moreover, special upper air observations were made at all kite and balloon stations, in order to have as complete information as possible in all parts of the country. Copies of these data and of those procured with sounding balloons have been forwarded to the International Commission for publication with similar data from other countries.

The results of the sounding balloon campaign at Royal Center are given in the two papers following—that by Mr. Fergusson describing the methods and instrumental apparatus employed, and the one by Mr. Samuels discussing the data themselves.

A series of sounding-balloon observations similar to that at Royal Center in 1926 will be made at Groesbeck, Tex., in October, which has been named the "international month" for 1927.

PART II. INSTRUMENTS AND TECHNIQUE

By S. P. FERGUSSON

The International Series of aerological soundings at Royal Center afforded opportunity for the trial of three new devices for facilitating the exploration of the atmosphere, namely, the light meteorograph and accessories designed in 1919 for use with *ballons-sondes*, the Rossby deflating valve, and an adaptation of the meteorograph to Assmann's method of the free-rising captive balloon.

METEOROGRAPHS AND ACCESSORIES

The design of the meteorograph, first described in the MONTHLY WEATHER REVIEW for June, 1920, 48:317–322, was based upon experience derived from the use of earlier apparatus by Assmann, Teisserenc de Bort, and Richard. Distinctive features are simplified construction permitting economical production in quantities, a two-traverse mechanism recording pressure on a scale twice that of earlier instruments and a single time-arc for all elements which simplifies the work of reading records. The temperature-element, of thin thermostatic metal, and the hygrometer, the hairs of which are separated, are more sensitive than similar elements in use previously and permit a very rapid rate of ascent and descent—a feature of great importance at stations near large bodies of water where ascensions must be completed within a short period. The very small weight (only one-third that of the lightest time-recording instrument in use previously) permits the use of molded pilot-balloons having an initial diameter of 30 to 50 centimeters expanded to about 130 centimeters before release.

Standardization of the meteorographs was accomplished easily and rapidly by means of the improved low-pressure-low-temperature apparatus designed by Messrs H. J. E. Reid and Otto E. Kirchner of the Langley Memorial Aeronautical Laboratory who kindly permitted the construction of a duplicate in the instrument laboratory of the Weather Bureau. In this apparatus the conditions of pressure and temperature during a high ascension are duplicated and it is possible to standardize six instruments simultaneously. Evaluations of the scales before and after ascensions were in close agreement and the performance of the Bourdon-tube pressure-elements was particularly good.

The meteorograph is protected from accidental injury by surrounding it with three hoops or buffers 30 centimeters in diameter, of rattan, secured by four threads to the corners of a piece of bright red silk about 1 meter square, which serves as a parachute and also to attract the attention of a possible finder.

BALLOONS

Data of the four types of balloons used are given in Table 1, below.

TABLE 1.—*Molded balloons used at Royal Center*

Average initial diameter	Average weight	Expanded for ascension diameter	Excess lift	Number necessary
Cm.	*Grams*	*Cm.*	*Grams*	
38	120	105	488	2
38	220	105	388	2
23	78	75	270	3
16	30	60	85	5

Larger molded balloons are not manufactured in America, and preliminary tests having shown that inflation of the 38-centimeter balloon beyond 110 centimeters was unsafe it became necessary to use two for each ascension in order to secure a free lift exceeding 500 grams. Premature explosion during inflation reduced the number available so far that, to secure the required number of ascensions, smaller balloons were used in combination with the larger during some ascensions and alone during the last 10.

TECHNIQUE OF ASCENSIONS OF BALLONS-SONDES

The technique of the ascensions at Royal Center followed closely that of earlier work in Europe and America described in detail in the *Annals of Harvard College Observatory, Vol. 68, part 1*, with the chief exception that pure compressed hydrogen was used instead of gas generated chemically as was the case at St. Louis.

Before every ascension the meteorograph was examined and adjusted with extreme care, particularly the pivots of recording mechanisms and the clocks which were oiled with kerosene to reduce friction to a minimum and avoid losses of records. The usual comparisons with a standard psychrometer were obtained at the last moment before ascension, while both instruments were exposed in air well stirred by a ventilating fan. Whenever possible the altitude and azimuth of the ascending balloons were observed every minute by means of a theodolite at one station and during some ascensions simultaneously at two stations 1,782 and 1,983 meters apart to obtain the direction and velocity as well as independent measures of height.

Summary.—The performance of the new equipment can best be estimated by comparing the 44 ascensions at Royal Center with the 21 ascensions at St. Louis in May, 1906, of Assmann balloons carrying meteorographs and accessories developed by Teisserenc de Bort at Trappes. The latter series was conducted by the writer.

TABLE 2.—*Comparison of ascensions with old and new equipment*

	St. Louis, May, 1906		Royal Center, May, 1926	
Balloons, inflated for ascension:				
Number and diameter ... cm.	(1)	175	(2)	105
Weight ... grams		1,500		250 and 340
Parachute, weight of ... do		425		25
Basket, etc., weight of ... do		115		40
Meteorograph, weight of ... do		400		175
Total weight, balloons and accessories		2,440		490 or 580
Excess lift ... grams		500		700 or 630
Greatest height attained ... meters		16,500		17,200
Average maximum height (meters):				
All ascensions (number and height)	(20)	10,090	(36)	10,690
First 34 ascensions				11,240
12 ascensions (best balloons)				11,700
Last 10 (small balloons)				9,250
Cost:				
Meteorograph	(1905)	$50	(1920)	$110
Accessories	(1905)	10	(1920)	2
Balloons ... each	(1905)	17	(1920)	8.50
Total, corrected to 1925		150		129

Probably there should be some allowance for the use, at St. Louis, of chemically generated gas, which, though dried, may have been inferior to that used at Royal Center. Fourteen of the first 34 ascensions at Royal Center were made with one 38-centimeter and one 23-centimeter balloon each, and the last 10 with five 15-centimeter balloons each, the lift of which was insufficient for high ascensions. The "best balloons" (Table 2) are 38 centimeters in diameter and weigh 120 grams, hence have a lift proportionately greater than that of heavier balloons of the same capacity.

The meteorograph and accessories were very satisfactory; there were a few instances of defective pressure records due to unsteadiness of balloons and minor defects of construction very easily avoided hereafter, and one clock stopped during part of an ascension. The pressure marker is controlled by gravity during its first traverse of the record sheet and the occasional violent jerking of two loosely secured balloons during some ascensions caused a decided widening of the traces on the upper side. This condition does not occur when one balloon is used, and was remedied by tying the balloons together so that they moved as one. It will be desirable, however, to alter the mechanism to prevent free motion of the marker if this can be done without increase of weight and cost. Further simplification of the technique of preparation of apparatus for use is highly desirable but can not be assured at present.

Since 1920 the price of the new meteorograph has advanced to $140, but that of balloons seems to be decreasing, and exploration with the new equipment continues to be less costly than with the larger, heavier apparatus formerly in use. As shown by the last 12 at Royal Center, high ascensions, occasionally to the stratosphere, can be obtained with pilot balloons 23 and 15 centimeters in diameter, at a cost of only about $2.25 for the number required, but the rate of ascent of a number of balloons is smaller than that of a single balloon having the same lift, consequently the ventilation is more than likely to be insufficient for ascensions during the daytime and, moreover, the apparatus may be carried long distances before it reaches ground.

Obviously, the height attainable by a rubber balloon will depend largely upon the range of expansion, which is retarded by cooling of the gas during the ascent, and limited by loss of elasticity that occurs when rubber is exposed to low temperatures. The 38-centimeter balloon will expand to about 200 centimeters before explosion or twice the diameter when inflated for ascension; that this allowance for expansion is insufficient is indicated by the fact that the maximum height at Royal Center was only 5,500 meters above the average maximum attained by the best balloons while at St. Louis the excess was 6,410 meters, and that the average diameter of inflated balloons at the beginning of the 11 highest and 5 lowest ascensions was 102.8 and 104.6 centimeters, respectively. However, the number of ascensions was too small and the quality of the balloons too variable to establish a standard of inflation.

All data available confirmed earlier conclusions, that the greatest and the highest average maximum heights and the most rapid rates of ascent and descent will be attained by the use, during each ascension, of a single large, light balloon having sufficient free lift, without preliminary expansion, to carry the lightest procurable meteorograph and accessories. For the highest ascensions it will probably be necessary to use the Dines meteorograph weighing 28 grams instead of the heavier time-recording instrument used at Royal Center.

Recently (1927) excellent sheet-rubber balloons 77 to 150 centimeters in diameter, weighing 680 to 2,400 grams and costing $5 to $17.50, have become available and tests thereof are in progress, the results of which so far, are encouraging. However, in view of the superiority of spherical molded balloons, large sizes of which are difficult to manufacture and not now procurable in America, it is desired to interest manufacturers in experimenting with cylindrical or other forms possibly more economical to produce and having greater capacity than the 38-centimeter balloon whose limitations have been discussed.

THE ROSSBY DEFLATING VALVE

The purpose of this device, invented by Dr. C.-G. Rossby, of Sweden, is the deflation of balloons at any predetermined time after ascension begins so they may be used repeatedly and the cost of exploration with *ballons-sondes* thereby materially reduced. A valve in the neck of the balloon is kept closed by an elastic cord until the latter is burned through by a fuse timed for the period and height desired. At Royal Center two of these valves constructed and tried under Doctor Rossby's supervision functioned perfectly during all trials at various heights up to 1,500 meters. In August three of five ascensions by the Hobbs expedition to Greenland were successful, deflation occurring as timed, at 500, 800, and 1,800 meters, respectively. The two failures during ascensions timed for greater heights were probably due to obstruction of the valve by water condensed from the gas which was generated from calcium hydrid and not thoroughly dry.

From these experiments it appears that the height attainable when this device is used will depend chiefly upon the weight of the fuse and the rate of ascent. The valve used at Royal Center weighed 70 grams, the fuse 40 grams per meter, and the rate of burning was 40 centimeters per minute; consequently, if the usual ascensional rate of 160 to 200 meters a minute is maintained, the maximum height attainable should be between 3,500 and 5,500 meters. A large free lift will be necessary if very high limited ascensions are desired.

Dr. J. E. Church, jr., of the University of Nevada, who aided in the ascensions in Greenland, suggests that greater certainty of action and improved efficiency can be secured by the use of three or four balloons, preferably the 23-centimeter size, all but one of which are exploded by the fuse, the remaining balloon serving as a parachute. This experiment has not been tried.

THE FREE-RISING CAPTIVE BALLOON

(1) If a captive balloon pulls out its line from a controlled reel the height attained will depend largely upon the wind, the pressure of which drives the balloon downward. (2) If the line is reeled out so rapidly that the only restraint is the increasing weight the balloon will move with the wind, rising freely until the weight equals the free lift, and attain a greater height than will the brake-controlled balloon. Since 1904, using one to three rubberized silk balloons having a capacity of 20 cubic meters each, flown with the wire and reel employed at other times in kiteflying, the German Aeronautical Observatory at Lindenburg has achieved very remarkable results by means of the second method. A maximum height of 6,000 meters has been reached with three balloons and the average maximum during one year is about 3,000 meters. Usually a high ascension is accomplished within an hour, and very satisfactory ascensions have been secured when the velocity of the wind exceeded 5 meters a second; the highest velocity during an ascension was 10 meters a second. Since, to reach a height of 5,000 meters a balloon of rigid materials (rubberized silk) must be able to rise when half inflated, it follows that, as is the case with *ballons-sondes*, a rubber balloon should be more efficient as a captive than the rigid one. In a discussion published in 1909 Assmann advised a large rubber balloon having one-half the capacity of the one made of rubberized silk, and evidently the smaller ones used as *ballons-sondes* were employed to some extent, particularly by the German expedition to East Africa in 1907, which carried 12,000 meters of 0.3 mm. music wire for use as line, but comparisons of the two types of balloons are not available. This improved method is so superior to that of the ordinary captive balloon that a descriptive name is desirable; accordingly, I have suggested the compounds "free-rising captive" which is self-explanatory, or "free-captive" which, though not so definite, is shorter and indicates the distinctive feature with sufficient clearness.

Since the free lift of the 38-centimeter balloon already described is practically the same as that of the larger, heavier ones employed by Assmann, it appeared probable that the former might prove to be satisfactory used as a free-captive; accordingly, a plan for an experimental trial was offered by the writer in September, 1925. In our discussions of this application of new equipment fear was expressed that the line of very small music wire would be very difficult to manage, but a preliminary trial was authorized during the international series at Royal Center. The reel and other equipment improvised for the occasion were not very suitable for such an experiment, but the results, even under these unfavorable circumstances, were very encouraging. The highest of the three ascensions (to 1,200 meters, reached with 1,700 meters of No. 2 wire) required only 24 minutes, during which period the velocity of the wind varied between 1 and 4 meters a second. When reeling in began one of the two balloons exploded but the other fell so slowly that the line rested on the ground only a few minutes, probably because of a temporary descending wind. The balloons were much steadier than kites and the line gave no trouble whatever; at no time was there a slackening sufficient to cause loops, although the pull never exceeded 1 kilogram.

The most important factor in exploration by this method is the vertical movement of the balloon, which, in order to maintain adequate ventilation of the meteorograph on clear days, should not fall much below 150 meters a minute. The rate of ascent is highest as the balloon leaves ground, decreasing as the weight of wire increases until the greatest height is reached; up to this point the balloon has moved with the wind, which does not affect the height. When reeling in begins, the wind, combined with the speed of reeling, drives the balloon downward at a rate that is greatest at the beginning of the descent. Therefore by utilizing records during ascent and descent, when the rate approximates 150 meters a minute, it should be possible during most ascensions to secure accurate data at all heights up to the maximum. The maximum height can be computed from data of the free lift and surface of the balloons, the velocity of the wind, and weight of wire; the size or strength of wire desirable to use will depend upon the highest wind likely to occur during an ascension. For example, assuming that the balloon is to be used chiefly when the wind is too light for kites (below 4 or 5 meters a second) and that the pressure of wind upon a sphere is about one-half that on a normally exposed plane having the same surface, the total pressure on a balloon 150 centimeters in diameter in a 5-meter wind will be 1.62 kilograms at sea level, or about one-fourth of the safe working strain of a No. 00 wire (the smallest music wire manufactured). The pressure of the wind on the line is negligible; probably not more than one-sixth that on a normally exposed flat plate whose surface is equal to that of the line, or about 0.2 kilogram on 5,000 meters of No. 00 wire in a 5-meter wind.

All data available, including the experiments at Royal Center and a very obvious one of suspending short lengths freely without strain, show conclusively that, compared with larger wires used in kiteflying, the smallest music wires are far more easily controlled, and injurious bends, loops, and "kinks" more easily prevented. It is probable that most instances of kinking occur after wire under strain has been drawn over some object (a branch of a tree or corner of a building) small or sharp enough to cause permanent bends which form loops whenever tension slackens. It is possible that small wires are more easily weakened by rust than are the larger sizes, but a protective covering of oil is easily applied to wire on the storage drum.

The data in Table 3 will be useful if wires and balloons larger than those described herein are considered desirable.

TABLE 3.—*Data of music wire useful in aerological exploration*

Music-wire gauge number	Diameter		Weight of 1,000 meters	Ultimate tensile strength
	Mm.	*Inch*	*Kilograms*	*Kilograms*
00	0.20	0.008	0.29	10
0	0.22	0.009	0.33	14
1	0.25	0.010	0.40	17
2	0.27	0.011	0.49	21
3	0.30	0.012	0.59	26
4	0.34	0.013	0.69	31
5	0.37	0.014	0.84	37
6	0.42	0.016	1.05	44
7	0.46	0.018	1.32	52
8	0.50	0.020	1.63	61
9	0.55	0.022	1.95	74
10	0.61	0.024	2.25	85
11	0.66	0.026	2.60	97
12	0.71	0.028	3.08	113
13	0.76	0.030	3.56	126
14	0.81	0.032	4.00	140
15	0.86	0.034	4.52	148
16	0.91	0.036	5.00	162
17	0.97	0.038	5.71	178
18	1.02	0.040	6.37	189
19	1.07	0.042	6.94	203
20	1.12	0.044	7.46	223
21	1.17	0.046	8.33	236
22	1.22	0.048	9.09	256
23	1.29	0.051	10.00	281
24	1.40	0.055	11.48	311
25	1.50	0.059	13.51	350
26	1.60	0.063	15.63	402
27	1.70	0.067	17.54	450
28	1.80	0.071	20.00	533
29	1.88	0.074	22.22	590
30	1.98	0.078	24.39	657

In consequence of slight variations in diameter the weights and tensile strengths of different lots of wire are likely to vary 5 per cent or more from the values stated, and specimens from the same piece will sometimes vary in strength 2 per cent or more. Also deterioration with use causes a gradual reduction of strength. Accumulated experience indicates that the working strain ordinarily should not exceed two-thirds of the ultimate tensile strength.

The following suggestions are offered regarding equipment and technique for future use of this method:

Reel.—The storage drum recommended is a light, two-flanged cast-iron pulley of standard design, the diameter and face of which, respectively, are 422 and 100 millimeters (17.5 and 4 inches); the circumference is so nearly 1.4 meters that the error of registration, of a counter geared direct to the axis, will be about 1 per cent; therefore negligible for the small wire used. The drum may be operated by hand or power, but if by power a quick-acting reversing gear should be provided so that, with the motor running continuously, the speed and direction of winding are at all times under control and can be reversed instantly in emergency. One simple device of this kind consists of two belts, preferably round, one straight and the other crossed, connecting the drum with the motor. These belts are loose but may be tightened alternately by means of a single lever carrying two loose pulleys bearing on the belts. The drum, motor, etc., should be mounted in a light box or frame that can easily be rotated about a vertical shaft to allow for changes in the direction of the wind. The speed of winding will depend upon the size and free lift of the balloons and probably should be at least 300 meters a minute. The pull or strain will always be too small to operate guide pulleys or separate counting mechanisms and the line must be wound directly on or from the drum without touching anything.

Since, as already stated, the line must be reeled out as rapidly as the balloon rises and kept approximately horizontal at the ground, the reel can be operated most efficiently if it is placed on a roof or tower with free exposure in all directions; the line then can be kept above near-by trees, etc., and the maximum height easily ascertained.

Meteorograph and accessories.—The small meteorograph already described is easily modified for use with the captive balloon by substituting ink pens and ruled paper for the markers and metallic record sheets used during very high ascensions. Since the heights at present are not likely to exceed 5,000 or 6,000 meters it will be advisable to widen the scales of temperature and pressure, the former to 1 millimeter for 1° C. and the latter to a range of 6,000 meters for the width of the record sheet. The exposure of the thermometer and hygrometer may require improvement to insure proper ventilation on clear days. The basket and parachute may prove to be unnecessary, but are advisable at least when wind and weather are unfavorable for ascensions.

NEPHOSCOPES AND OBSERVATIONS OF CLOUDS

Observations several times daily of the heights and motions of clouds formed an important part of the aerological program of May, 1926, and at Royal Center provided information regarding the nephoscope and accessories issued to stations in 1921. The nephoscope proper (a mirror in a circular frame graduated to 5° of azimuth and resting on three short legs) probably is amply satisfactory, and the separate eyepiece and its support, with slight changes, should also be considered satisfactory; but, in the interests of efficiency and the convenience of the observers, the installation or location and methods of use should be changed wherever this is possible. When the nephoscope was designed uniformity of installation was emphasized, and since, at nearly all stations, the instrument could be placed on a roof the support approved consisted of a large iron plate supported by an iron column fixed in a heavy block of concrete resting on leveling screws. The nephoscope and accessories are kept on this stand and protected from the weather by a copper cover detachably secured to the stand by means of bayonet joints.

At Royal Center the nephoscope is some 50 meters distant from the nearest building, and, apart from this inconvenience, observations often are prevented or seriously interfered with by wind that disturbs the eyepiece and index, rain that blurs the mirror, and the various outdoor noises that prevent hearing the timing clock. The bayonet joints in the soft metal of the cover bent and broke after a short period of use and other means of security against wind and rain became necessary. These conditions of exposure doubtless exist to some extent at most stations and, together with certain deficiencies of design and construction, can easily be corrected, as follows:

Nephoscope.—For the greatest convenience of operation the nephoscope should be self-contained; i. e., the mirror and eyepiece together mounted on a short tripod stand. The eyepiece should be on a swinging arm in two or three jointed sections for convenience in observing through a wide range of altitude. The outdoor stand may be retained for emergencies when conditions are unusual, but wherever the windows of an office or observatory provide good visibility it will be most convenient, particularly in stormy weather, to place the nephoscope on a window sill where observations can be made with ease and in comfort. Proper leveling and orientation are secured by attaching to window sills on different sides of a room an iron plate having sockets for the legs of the nephoscope; such plates are inexpensive and easily installed in any convenient place indoors or outdoors, and since the nephoscope is removed to the room after use a cover will not be needed. If the separate eyepiece and stand are retained the horizontal sliding arm (difficult to adjust) should be replaced by a pivoted, swinging arm in two sections.

Timing clock.—The small clock now used for timing relative velocities should be replaced by a watch, preferably one with an eight-day movement, beating 240 times a minute, held to the observer's ear by the springs of an ordinary head telephone. Almost any watch will do for timing if the frequency of beat is allowed for, but one beating 240 times a minute will be most convenient. The Ingersoll watches are very satisfactory for this purpose; also, observations indoors can be timed by the clock of the "triple register."

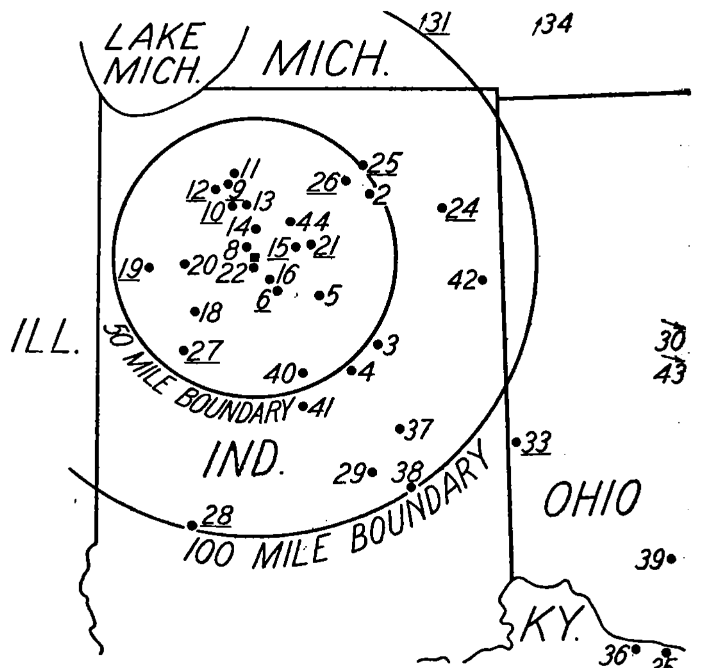
Long experience with many instruments used in measing clouds indicates that, with very simple apparatus, used when conditions are comfortable, accurate and valuable observations require no more effort or time than poor or unsatisfactory observations or estimates without the aid of instruments. It should be unnecessary to repeat here the fact, obvious to all students, that, considering time, cost, and effort, observations of clouds yield more information concerning the upper atmosphere than any other method of exploration.

PART III. THE RESULTS OF THE ASCENSIONS

By L. T. Samuels

A total of 44 soundings was made during the month, of which 39 instruments have been returned. Table 4 contains general information concerning the individual observations.

In Figure 1 are shown the landing places of the balloons, the numerals indicating the serial number of the observation. Fifty-six per cent of the returned instruments landed within 50 miles of Royal Center and 80



LANDING PLACES OF SOUNDING BALLOONS SENT UP FROM ROYAL CENTER, IND. MAY 1926

Fig. 1

per cent within 100 miles. The greatest distance an instrument was found was 425 miles, this one having fallen on a mountain peak in Pennsylvania. The distance away an instrument falls, however, is not always a reliable indication of the height reached, owing to superposed opposing winds. For example, the greatest height during the series was reached on the 6th although this instrument fell only 11 miles away, having traveled in a southerly wind in the lower levels and a northerly wind in the higher levels.

In three cases the records were returned damaged, making it impossible to determine what height these reached. Fourteen of the records showed the instruments to have reached the stratosphere.

TABLE 4.—*Summary of the observations*

Serial number of ascent	May, 1926	Time of ascent 90th meridian	Stratosphere: Height of base above mean sea level	Stratosphere: Temperature, at base	Maximum height above mean sea level	Minimum temperature	Meteorograph found—: Place	Meteorograph found—: Distance and direction from Royal Center	Balloons: Number used	Balloons: Initial diameter of each	Balloons: Net free lift
			Km.	*° C.*	*Km.*	*° C.*		*Km.*		*Cm.*	*Grams*
1	1	6:34 p					Not returned		2	38	980
2	2	6:20 p			7.7	−27.6	Pierceton, Ind	76, ne	2	38 and 23	528
3	3	6:18 p			5.3	−16.4	Fairmont, Ind	87, se	2	38	630
4	4	6:11 p			8.2	−31.5	Elwood, Ind	85, se	2	38	683
5	5	6:06 p			12.0	−64.6	Peru, Ind	39, ese	2	38	635
6	6	6:09 p	15.8	−69.3	17.2	−69.3	Logansport, Ind	18, se	2	38	604
7	7	0:30 a					Not returned		2	38	831
8	7	7:06 a			1.7	15.2	Thornhope, Ind	8, nw	2	38	715
9	7	1:06 p	12.3	−60.4	12.8	−60.4	Knox, Ind	45, nnw	2	38	554
10	7	6:20 p	14.4	−68.6	15.6	−68.6	Winnemac, Ind	32, nnw	2	38	616
11	8	0:30 a			12.7	−65.2	Knox, Ind	50, nnw	2	38	679
12	8	6:45 a	[1] 12.4	−57.0	[1] 13.0	−58.9	North Judson, Ind	43, nw	2	38	645
13	8	1:27 p	([2])				Monterey, Ind	31, nnw	2	38	641
14	8	6:20 p			9.3	−47.9	Kewauna, Ind	18, n	2	38	844
15	9	6:21 p	11.6	−53.5	13.7	−53.5	Macy, Ind	26, ene	2	38	713
16	10	7:03 a			6.8	−13.1	Logansport, Ind	13, se	2	38	730
17	10	6:25 p					Not returned		2	38	638
18	11	6:25 a			12.5	−52.8	La Fayette, Ind	45, sw	2	38	743
19	11	5:43 p	11.5	−61.8	13.1	−61.8	Remington, Ind	61, w	2	38	739
20	12	6:35 a			12.0	−54.9	Wolcott, Ind	39, w	2	38	700
21	12	6:15 p	11.3	−63.0	12.6	−63.0	Deedsville, Ind	34, ene	2	38	600
22	13	6:39 a	([2])				Boone Township, Ind	3, s	2	38	705
23	13	10:25 a					Not returned		2	38 and 23	375
24	13	6:23 p	9.8	−53.9	13.1	−57.6	Fort Wayne, Ind	113, ene	2	38 and 23	330
25	14	6:27 a	10.1	−44.9	11.4	−46.0	Warsaw, Ind	76, ne	2	38 and 23	330
26	14	5:30 p	8.9	−44.5	11.5	−45.0	Harrison Township, Ind	69, ne	2	38 and 23	255
27	15	6:48 a	10.0	−46.9	11.9	−50.8	West Point, Ind	68, sw	2	38 and 23	375
28	15	6:32 p	11.8	−56.9	13.1	−57.5	Cataract, Ind	161, ssw	2	38 and 23	375
29	16	6:41 p			10.6	−58.2	Cadiz, Ind	130, se	2	23	343
30	17	6:33 p	([2])				Rugged Mountain, Pa	684, ese	2	38 and 23	250
31	18	6:43 p	[3] 14.6	−70.9	14.6	−70.9	Fowlerville, Mich	242, ne	2	38 and 23	330
32	19	6:23 p					Not returned		3	23	280
33	20	6:08 p	13.6	−65.7	14.0	−65.7	Rose Hill, Ohio	177, se	3	23	350
34	21	6:39 p			5.7	−12.6	Tilbury, Ont	322, ne	2	38 and 23	479
35	22	6:37 p			[4] 3.4	−49.0	Vanceburg, Ky	343, se	5	15	235
36	23	6:09 p			9.9	−50.0	Sardis, Ky	306, se	5	15	305
37	24	6:33 p			5.8	−11.8	Muncie, Ind	117, se	5	15	270
38	25	6:25 p			11.1	−50.3	Newcastle, Ind	142, se	5	15	255
39	26	6:20 p			[4] 4.3	−40.5	New Burlington, Ohio	257, se	5	15	250
40	27	5:53 p			13.0	−60.5	Kempton, Ind	72, sse	5	15	238
41	28	6:27 p			11.4	−50.9	Sheridan, Ind	90, sse	5	15	195
42	29	5:59 p			[4] 4.2	−42.6	Monroe, Ind	134, e	5	15	185
43	30	6:25 p			11.2	−50.6	Milford Township, Ohio	322, ese	5	15	185
44	31	6:23 p			1.9	11.7	Rochester, Ind	29, ne	5	15	200

[1] Determined trigonometrically from observations at two stations.
[2] Record damaged.
[3] Heights above 9 km. based upon mean rate of ascent.
[4] Pressure-element failed above this height; from an estimate based on the minimum temperatures these heights were as follows, No. 35, 10,700 meters, Nos. 39 and 42, 9.500 meters.

An unusually large proportion of the instruments were found to the *west* of the station. The first group of these occurred on the 7th and 8th (Nos. 8 to 14) when this region was under the influence of a "saddle"; i. e., a high-pressure area to the north and south and low pressure to the east and west, when deep southeasterly winds prevailed; the second group occurred on the 11th and 12th (Nos. 18 to 20) when the station was on the front side of an extensive high-pressure area covering the entire western part of this country and Canada and deep easterly winds prevailed; the third group occurred on the 15th (Nos. 27 and 28) when Royal Center was between a LOW to the east and a HIGH to the west with upper winds northeasterly.

The lowest temperature recorded during the series was −70.9° C., at 14.6 kms. on the 18th. This has been exceeded on two previous occasions on this continent, viz, at St. Louis on January 25, 1905, when −79.4° C. was recorded at 14.8 kms., and at Woodstock, Ont., on November 5, 1913, when −74.5° C. was recorded at 12.4 kms.

Figure 2 shows the vertical temperature gradients for the individual observations. The temperatures in ° C. are shown for the surface, the highest altitude and the base of the stratosphere. The wind directions have been included wherever these were observed.

As is usually found, the altitude of the base of the stratosphere fluctuated considerably. In general, it was high over high pressure, particularly over the rear of high pressure and low over low pressure and likewise, particularly over the rear of low pressure. This relationship is in agreement with the results of earlier sounding balloon observations made in this country (1) and elsewhere (2).

The maximum altitude of the base of the stratosphere (15.8 kms.) for the series was observed on the 6th when the station was on the western side of a high-pressure area. The lowest altitude (8.9 kms.) was observed on the 14th, at which time the station was on the western side of a low-pressure area.

The fluctuation in the altitude of the base of the stratosphere during relatively short periods is clearly indicated in Figure 2. Thus, on the 7th it was 12.3 kms. at 1.06 p. m. and 14.4 kms. at 6.20 p. m., showing a change of 2.1 kms. in 5 hours on the 14th it was 10.1 kms. at 6.27 a. m. and 8.9 kms. at 5.30 p. m., changing 1.2 kms. in 12 hours, and during the following 12 hours it again rose to 10.0 kms.

The isotherms for 0° C., −25° C., and −50° C. have been drawn across the temperature curves in Figure 2 in order to give an indication of the relative variation in the altitude of these isothermal surfaces. It is evident that the changes in temperature from day to day are as great, if not greater, at 10 kms. than they are at the lower levels of 2 to 4 kms.

Figure 3 shows the free-air isotherms over Royal Center during the month. The altitude of the base of the stratosphere is indicated by the letter "S." There will be noted a periodic change in this elevation. Thus from a maximum height on the 6th there is a general lowering to a minimum on the 14th followed by a rise to a maximum on the 18th.

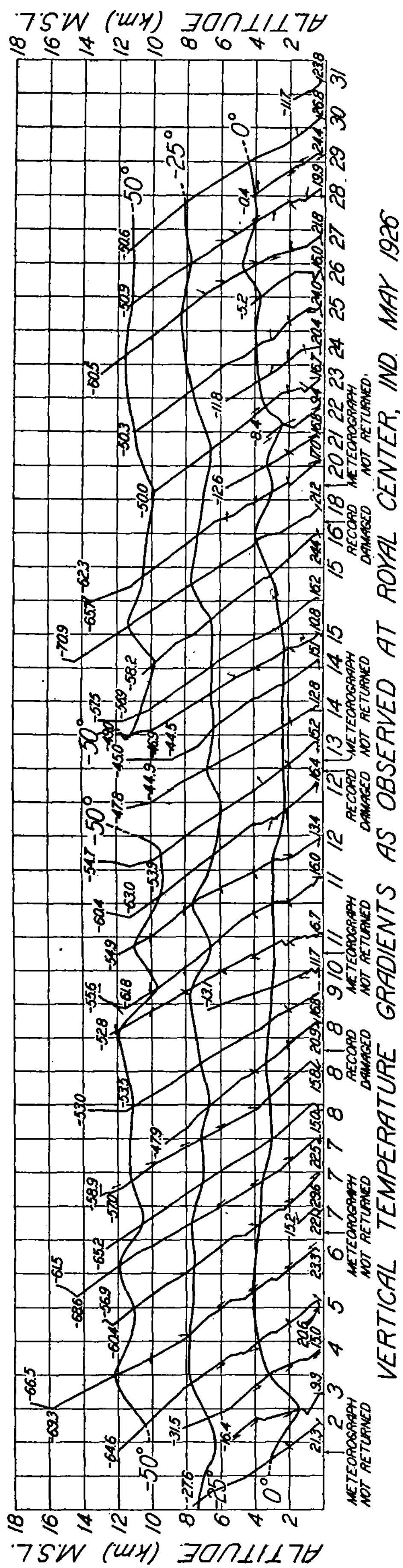

VERTICAL TEMPERATURE GRADIENTS AS OBSERVED AT ROYAL CENTER, IND. MAY 1926
ALTITUDE (km) M.S.L.
METEOROGRAPH NOT RETURNED
RECORD DAMAGED

FIG. 2

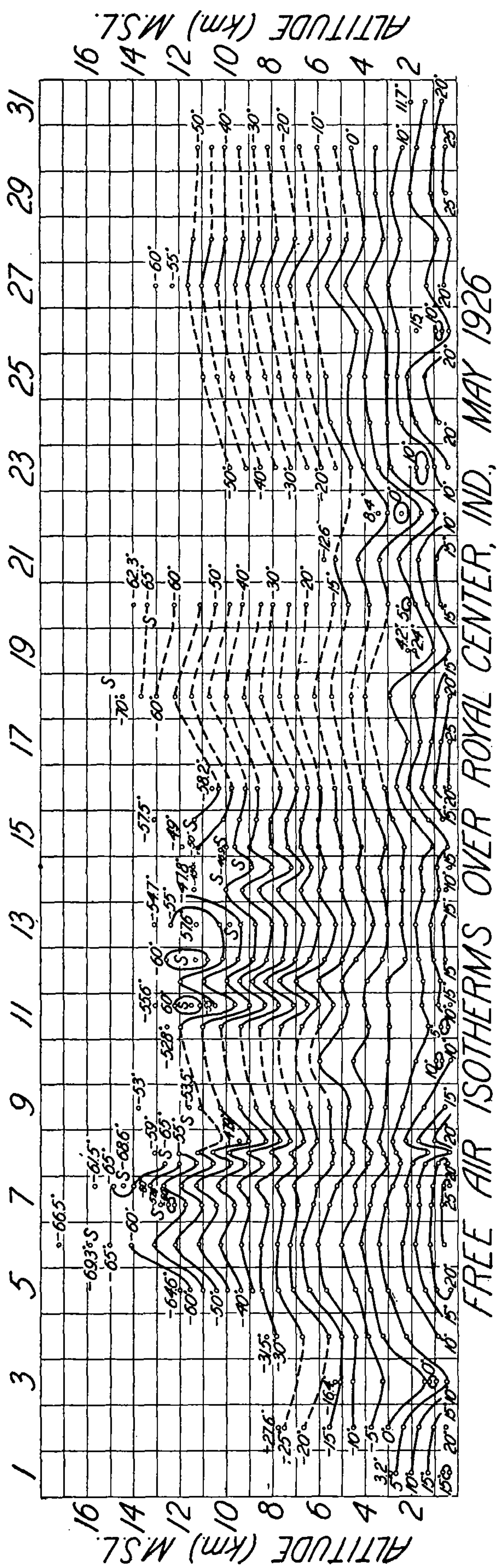

FREE AIR ISOTHERMS OVER ROYAL CENTER, IND., MAY 1926
ALTITUDE (km) M.S.L.

FIG. 3

More or less marked decreases in temperature are evident in the lower levels on the 3d, 8th, 19th, 22d, and 26th. That of the 8th was due to nocturnal radiation, the records for this date representing 12.30 a. m., 6.45 a. m. and 6.20 p. m., respectively. It will be seen that

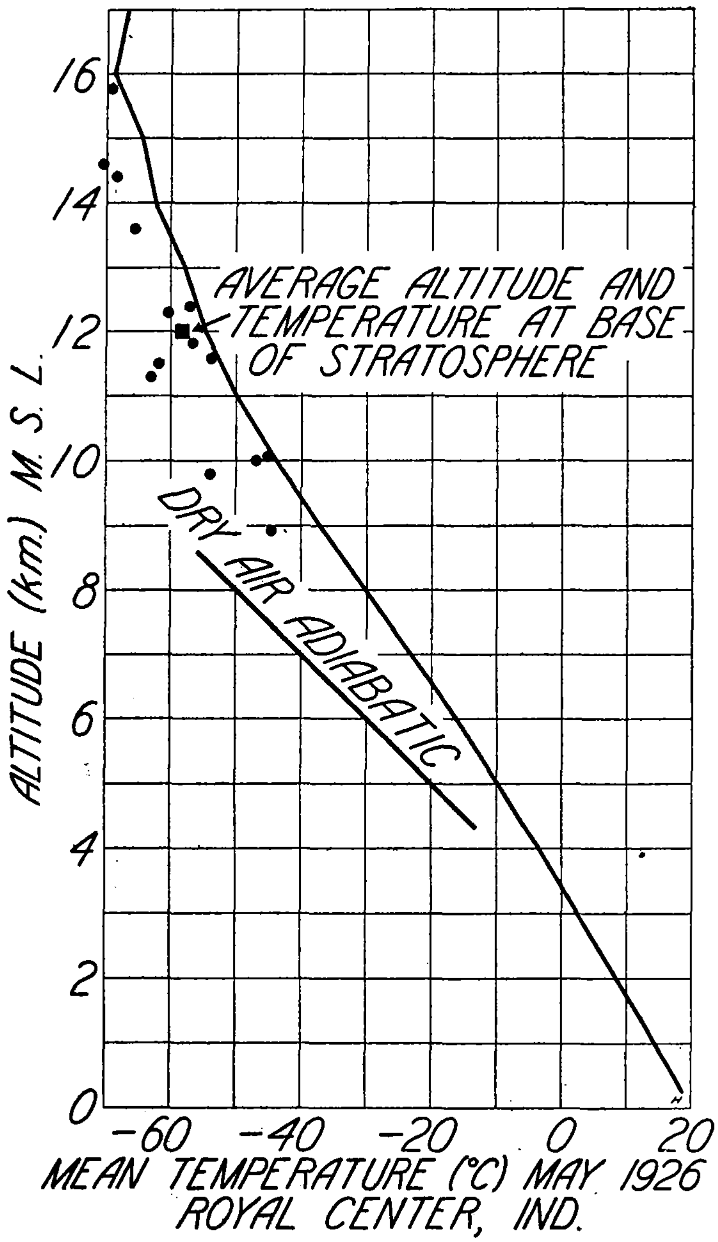


FIG. 4

the drop in temperature due to radiation was confined to the air below 2,000 m. (M. S. L.).

The fall in temperature on the other dates mentioned, viz, the 3d, 19th, 22d, and 26th occurred in connection with the passage of a high pressure area. It is interesting to note the height to which the temperature fell in each of these cases. It will also be observed that this lower stratum, wherein the temperature decreased, was surmounted in each case either by an inversion or by an isothermal layer.

Separated from these more or less marked fluctuations found in the lower levels by a layer several kilometers thick wherein the temperature changes were relatively small there occurred in the higher levels a series of rather pronounced fluctuations in temperature. (See fig. 3.) The latter appear to be definitely associated with the altitude of the base of the stratosphere. Thus when the temperature rises at these levels the stratosphere also rises, whereas when the temperature falls the base of the stratosphere is found to have lowered. This relationship is apparently confined to the temperature changes at these higher elevations. W. H. Dines has found the correlation coefficient between the temperature at 8 kms. and the altitude of the stratosphere to be 0.74 with a small probable error. (2)

Figure 4 shows the mean temperature for the month, based on 28 observations, only one being used on days when more were made. The dots indicate the altitude and temperature of the base of the stratosphere for the individual observations, the extreme range (6.9 kms.) being nearly equal to the minimum altitude (8.9 kms.) above sea-level. The mean altitude of the base of the stratosphere was 12.0 kms. and the mean temperature − 58.4° C. The range in temperature at the base of the statosphere was 26.4° C., i. e., from −44.5° C. to − 70.9° C. Note that all of the points fall to the left of the mean curve, i. e., the temperature at the base of the stratosphere at any particular time is always lower than the *mean* temperature for that altitude. This is also brought out when the mean temperature for the base of the stratosphere, based on the 14 observations which reached it, is compared to the mean for the same altitude as shown by the curve. (See temperature indicated by square and that indicated by curve at 12 kms., fig. 4.) The reason for this is that in the individual observations the temperature usually increases abruptly at the base of the stratsophere and also because the stratosphere fluctuates in height thus causing the mean curve to fall to the right.

The relation between the altitude of the base of the stratosphere and the corresponding temperature is clearly shown by the distribution of the dots on this chart. Thus, when the stratosphere is low, its temperature is in general higher than when the stratosphere is high. The correlation coefficient found by Dines for these two variables is −0.68 with a small probable error. Some of the more significant other correlation coefficients obtained by Dines are given in Table 5. (2)

TABLE 5.—*Correlation coefficients*

	P_0	P_9	T_{1-9}	H_c	T_c	T_8
P_0	----------	.68	.47	.68	−.52	----------
P_9	.68	----------	.95	.84	−.47	----------
T_{1-9}	.47	.95	----------	.79	−.37	----------
H_c	.68	.84	.79	----------	−.68	.74
T_c	−.52	−.47	−.37	−.68	----------	----------
T_8	----------	----------	----------	.74	----------	----------

P_0 is the barometric pressure at M. S. L.
P_9 is the barometric pressure at 9 km.
T_{1-9} is the mean temperature from 1 to 9 km.
H_c is the height of the base of the stratosphere.
T_c *is the temperature at the base of the stratosphere.*
T_8 is the temperature at 8 km.

TABLE 6.—*Mean temperatures* (°C)

Altitude (km.) M. S. L.	Equatorial[1] (annual)	St. Louis[2] (May, 1906) Lat. 38° 38′ N.	Royal Center (May, 1926) Lat. 40° 53′ N.	Toronto[3] (annual) Lat. 43° 40′ N.	London[4] (annual) Lat. 51° 30′ N.	Pavlovsk[5] (annual) Lat. 59° 41′ N.
1	22.0	8.1	13.9	5.3	5.0	−1.8
2	17.0	1.6	8.2	1.8	0.2	−6.4
3	12.0	−4.1	2.2	−3.4	−5.3	−12.0
4	6.0	−10.1	−3.7	−8.9	−11.3	−17.8
5	−1.0	−15.9	−10.1	−15.3	−18.2	−23.9
6	−8.0	−21.1	−16.3	−22.1	−25.2	−30.3
7	−15.0	−28.2	−23.2	−29.5	−32.3	−37.1
8	−22.0	−36.4	−30.3	−37.1	−39.4	−43.3
9	−30.0	−44.5	−37.3	−43.7	−45.5	−48.0
10	−38.0	−52.0	−44.1	−49.8	−50.8	−50.4
11	−46.0	−55.8	−50.1	−53.7	−53.4	−51.3
12	−54.0	−57.4	−55.0	−56.8	−54.2	−51.0
13	−62.0	−57.7	−58.1	−59.0	−54.3	
14	−70.0	−58.5	−62.7	−60.5	−54.1	
15	−75.0	−60.4	−64.7	−62.0		
16	−78.0	−59.2	−69.0	−62.1		
17	−80.0		−66.9	−61.6		

MEAN TEMPERATURE GRADIENTS

1–2	5.0	6.5	5.7	3.5	4.8	4.6
2–3	5.0	5.7	6.0	5.2	5.5	5.6
3–4	6.0	6.0	5.9	5.5	6.0	5.8
4–5	7.0	5.8	6.4	6.4	6.9	6.1
5–6	7.0	5.2	6.2	6.8	7.0	6.4
6–7	7.0	7.1	6.9	7.4	7.1	**6.8**
7–8	7.0	**8.2**	**7.1**	**7.6**	**7.1**	6.2
8–9	**8.0**	8.1	7.0	6.6	6.1	4.7
9–10	**8.0**	7.5	6.8	6.1	5.3	2.4
10–11	**8.0**	3.8	6.0	3.9	2.6	0.9
11–12	**8.0**	1.6	4.9	3.1	0.8	−0.3
12–13	**8.0**	0.3	3.1	2.2	0.1	
13–14	**8.0**	0.8	4.6	1.5	−0.2	
14–15	5.0	1.9	2.0	1.5		
15–16	3.0	−1.2	4.3	0.1		
16–17	2.0		−2.1	−0.5		
Number of observations		18	28	53	167	90

[1] Monthly Weather Review November, 1915.
[2] Annals Harvard College Observatory Vol. 68, Part 1. 1909.
[3] Upper Air Investigation in Canada, Part 1. 1915.
[4] Geophysical Memoirs No. 13, 1919.
[5] Meteorologische Zeitschrift, January, 1911.

Table 6 contains the mean temperatures and temperature gradients at several stations in latitudes ranging from the equator to practially 60° N. The values represent annual means for all of the stations except Royal Center and St. Louis which are for May. However, since there is usually little difference between spring and annual means practically the same agreement may be expected as if all were annual values. The average maximum gradient is indicated in bold-face type; it occurs at practically the same elevation at all of the stations. The maximum gradient is found at that altitude above which about one-third of the atmosphere exists. The equatorial observations show a persistence in the maximum gradient for a much greater interval than occurs at the other stations.

Figure 5 is a graphical representation of Table 6 and brings out a number of striking features. Among these is the opposite relationship as regards the latitudinal variation which occurs between the temperatures in the stratosphere and those in the troposphere. Although contrary to expectations in this respect, the temperatures in the stratosphere are higher at St. Louis than at Royal Center and Toronto. This is probably due to the relatively small difference in latitude between these places as well as to a possibly insufficient number of observations, especially in the higher levels, to determine true averages.

The inverse relationship existing between the average height of the stratosphere and the latitude is especially well shown in this figure, the wide difference between this altitude at the Russian station as compared to that over the equator being particularly striking.

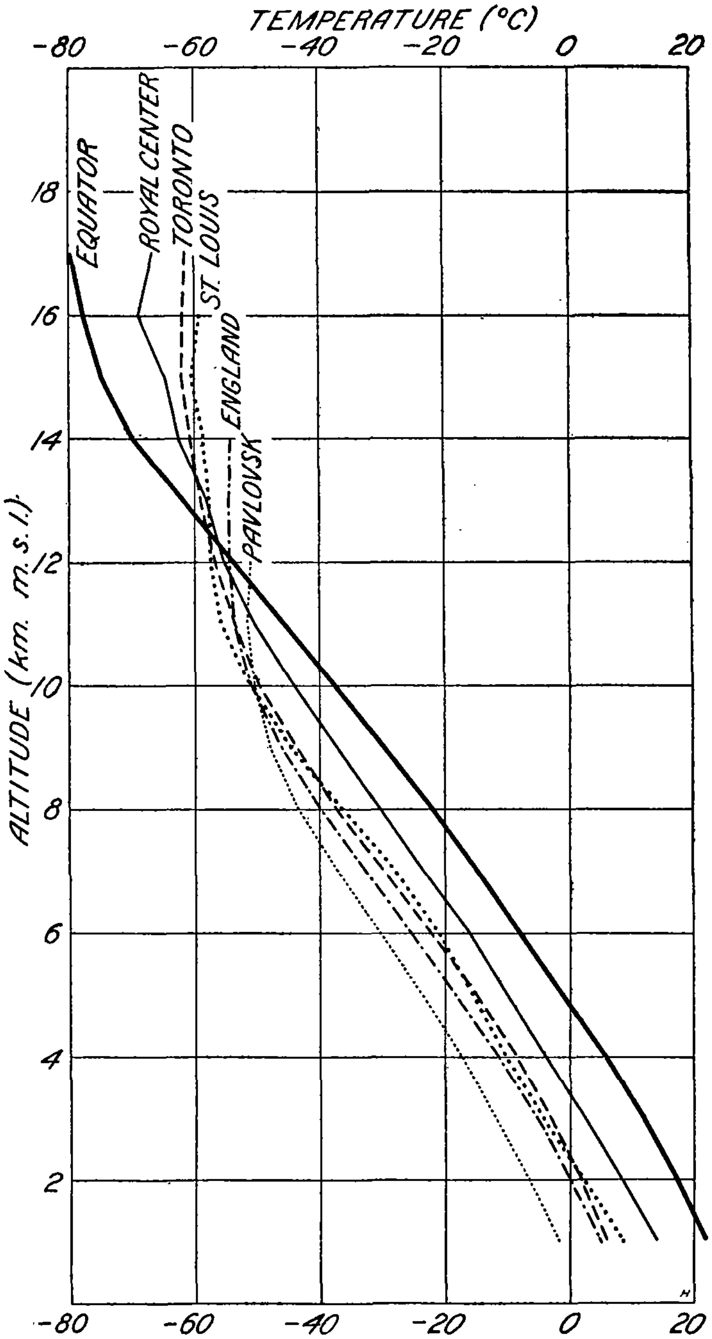


FIG. 5.—Mean vertical temperature distribution for stations in widely different latitudes. (See Table 3.)

Another feature brought out is the convergence of the lines at about 12 km., indicating practically the same mean temperature at this elevation at all of these widely separated places.

Table 7 contains a condensed summary of all previous sounding balloon observations made in this country.

TABLE 7.—*Series of sounding balloon observations made in United States to and including 1926*

Date	Place of observation	Number of ascensions	Number of instruments returned	Number of good records	Number that entered stratosphere	Maximum altitude (m.) M. S. L.	Where published
[1] 1904 (Sept. 15–Dec. 2)	St. Louis, Mo.	14	14	13	3	17,045	Annals Harvard College Observatory, vol. 68, pt. 1.
[1] 1905 (Jan. 21–July 25)	do.	21	18	13	5	16,790	Do.
[1] 1906 (Apr. 28–May 19)	do.	21	21	20	11	16,457	Do.
[1] 1907 (Oct. 5–Nov. 15)	do.	21	19	18	10	16,640	Do.
[1] 1908 (May 7–July 28)	Pittsfield, Mass.	4	3	3	1	17,695	Annals Harvard College Observatory, vol. 68, pt. 2.
1909 (Sept. 25–Oct. 12)	Fort Omaha, Nebr.	13	12	12	6	24,119	Bulletin Mount Weather Observatory, 1910, vol. 3, pt. 3.
1909 (Sept. 25–Oct. 12)	Indianapolis, Ind.	7	6	5	4	19,443	Do.
1910 (May 6–22)	Fort Omaha, Nebr.	20	16	16	1	25,303	Bulletin Mount Weather Observatory, 1911, vol. 4, pt. 4.
1910 (Aug. 9–Sept. 17)	Huron, S. Dak.	26	24	23	19	30,486	Do.
1911 (Feb. 8–Mar. 4)	Fort Omaha, Nebr.	25	22	22	21	24,105	Do.
1913 (July 23–Aug. 10)	Avalon, Calif.	23	15	13	10	32,643	Monthly Weather Review, July, 1914.
1914 (July 9–22)	Fort Omaha, Nebr.	21	20	19	15	31,602	Monthly Weather Review, May, 1916.
1926 (May 1–31)	Royal Center, Ind.	44	39	36	14	17,182	
Total		260	229	213	120		

[1] Under the auspices of the Blue Hill Observatory.

Table 8 contains the tabulated data for the individual sounding balloon observations made at Royal Center, with interpolations for the standard levels. The potential temperatures referred to a pressure of 1,000 mb. have been included for the computed levels.

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1911. SOUNDING BALLOON ASCENSIONS AT INDIANAPOLIS, OMAHA, AND HURON. Bulletin of the Mount Weather Observatory. Vol. 4, pt. 4.

(2) DINES, W. H.
1919. THE CHARACTERISTICS OF THE FREE ATMOSPHERE. Geophysical Memoirs No. 13.

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
May 2, 1926, p. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
6.20	225	980.7	21.3		296.0	60	15.21	sw.	6.7	10/10 st.-cu., N
6.21	253	977.6	21.9	−2.14	296.8			sw.	7.0	
	500		19.9					wsw.	16.0	
	750		17.8					wsw.	20.4	
	1,000		15.8					wsw.	21.6	
	1,250		13.9					wsw.	20.7	
	1,500		11.7					wsw.	20.4	
	2,000		7.6					sw.	20.5	
6.30	2,156	780.5	6.3	0.82	299.8			sw.	20.5	
	2,500		3.9					sw.	20.9	
	3,000		0.4							
	3,500		−3.1							
	4,000		−6.5							
	4,500		−10.0							
6.41	4,676	568.8	−11.2	0.69	307.6					
	5,000		−12.6							
	6,000		−16.8							
6.48	6,590	442.0	−19.3	0.42	320.4					
	7,000		−22.4							
6.53	7,704	380.2	−27.6	0.75	323.6					
May 3, 1926, p. m.:										
6.18	225	997.3	9.3		282.5	66	7.73	n.	7.2	2/10 ci.-st., WNW
	250		8.9			66	7.52	n.	7.2	
	500		4.6			70	5.94	nnw.	8.1	
	750		0.3			75	4.68	n.	9.0	
6.22	963	910.5	−3.3	1.71	277.0	78	3.63	n.	10.7	
	1,000		−2.9			77	3.70	n.	11.0	
	1,250		−0.2			69	4.15	n.	10.5	
6.24	1,274	875.4	0.1	−1.09	283.7	68	4.18	n.	10.4	
	1,500		−0.5			66	3.87	n.	12.0	
	2,000		−1.8			62	3.27	nnw.	17.2	
	2,500		−3.1			59	2.79	nnw.	15.3	
	3,000		−4.5			55	2.32	nnw.	15.4	
	3,500		−5.8			51	1.92	nw.	19.4	
6.32	3,610	651.9	−6.1	0.27	301.6	50	1.84	nw.	19.8	

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
May 3, 1926, p. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
6.35	3,995	621.0	−5.5	−0.16	306.5	50	1.94	nw.	20.0	
	4,500		−9.8			49	1.31	nw.	19.6	
	5,000		−14.1			48	0.87	nw.	21.8	
6.41	5,272	525.9	−16.4	0.85	308.3	48	0.71	nw.	21.2	
May 4, 1926, p. m.:										
6.11	225	994.2	15.0		288.5	49	8.36	se.	4.0	8/10 ci.-st., NNW
	250		14.8			49	8.25	se.	4.2	
	500		12.7			49	7.20	se.	6.3	
	750		10.6			48	6.13	s.	8.5	
6.15	891	918.1	9.4	0.84	289.4	48	5.66	s.	8.6	
	1,000		9.3			46	5.39	s.	7.8	
	1,250		9.1			42	4.86	s.	5.0	
6.16	1,384	865.2	9.0	0.08	293.9	40	4.59	ssw.	2.3	
	1,500		8.5			42	4.66	sw.	1.8	
6.19	1,962	806.9	6.3	0.47	297.0	50	4.77	nw.	5.5	
	2,000		6.1			50	4.70	nw.	6.0	
	2,500		3.9			51	4.12	wnw.	13.7	
6.24	2,980	712.0	1.8	0.44	302.8	52	3.61	wnw.	16.4	
	3,000		1.7			52	3.59	wnw.	16.6	
	3,500		−2.1			58	2.98	wnw.	18.8	
6.29	3,958	629.5	−5.5	0.75	305.4	63	2.44	nw.	21.2	
	4,000		−5.9			64	2.39	nw.	21.2	
	4,500		−10.5			72	1.81	nw.	18.1	
	5,000		−15.1			81	1.34			
6.39	5,538	512.5	−20.0	0.92	306.3	90	0.94			
	6,000		−22.0			88	0.76			
	7,000		−26.2			84	0.48			
	8,000		−30.5			79	0.28			
6.46	8,243	354.0	−31.5	0.42	325.0	78	0.26			
May 5, 1926, p. m.:										
6.06	225	989.5	20.6		294.5	25	6.07	sw.	2.7	Few ci.? (too low on horizon to observe with nephoscope).
	250		21.2					sw.	3.2	
6.07	368	973.3	24.2	−2.52	299.5			sw.	5.6	
	500		23.4					sw.	8.2	
6.09	641	943.3	22.5	0.62	300.5			sw.	9.0	
	750		21.5					ssw.	9.3	
	1,000		19.1					ssw.	8.0	
	1,250		16.7					ssw.	8.0	
6.13	1,441	859.4	14.9	0.95	300.6			ssw.	9.2	
	1,500		14.5					ssw.	9.5	
	2,000		10.9					wsw.	11.4	
6.17	2,145	790.0	9.9	0.71	302.6			wsw.	13.0	
	2,500		7.4					wsw.	14.0	
6.22	2,809	728.8	5.3	0.69	304.6			wnw.	12.7	
	3,000		5.3					wnw.	10.1	
6.24	3,096	703.5	5.3	0.00	307.7			wnw.	9.0	
	3,500		2.7					nw.	6.0	
6.26	3,512	668.3	2.6	0.65	309.3			nw.	6.0	
	4,000		−1.6					nnw.	3.1	
	4,500		−5.8					nnw.	2.2	
6.32	4,531	588.5	−6.1	0.86	310.6			nnw.	2.3	
6.34	4,773	570.4	−7.1	0.41	312.2			wnw.	4.5	
6.34½	4,853	564.9	−6.5	−0.75	313.8			wnw.	6.5	
	5,000		−7.3					w.	8.6	
6.36	5,146	544.0	−8.0	0.51	315.4			w.	7.6	
6.38	5,446	523.5	−8.0	0.00	318.9			wnw.	7.6	

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Potential temperature	Humidity		Wind		Remarks
						Relative	Vapor pressure	Direction	Velocity	
May 5, 1926, p. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
6.38	6,000		−12.0					nw.	8.4	
	7,000		−19.3					nw.	8.1	
	8,000		−26.6							
6.50	8,211	362.3	−28.1	0.73	327.4					
	9,000		−35.9							
	10,000		−45.7							
7.02	10,138	275.5	−47.0	0.98	326.8					
	11,000		−55.2							
7.12	11,997	205.5	−64.6	0.95	327.7					
May 6, 1926, p. m.:										
6.09	225	988.2	23.3		297.3	32	9.16	se.	3.1	4/10 ci. and ci.-st., wnw.
	250		23.5			31		se.	3.6	
6.10	468	961.2	25.4	−0.86	301.8	25	8.12	se.	6.4	
	500		25.2			25		se.	6.2	
	750		23.3			25		se.	7.7	
	1,000		21.4			25		se.	7.0	
	1,250		19.5			24		se.	5.3	
	1,500		17.6			24		se.	5.4	
6.17	1,627	840.4	16.7	0.75	304.5	24	4.56	se.	4.8	
	2,000		13.4			25		se.	2.4	
	2,500		9.0			27		e.	1.6	
6.24	2,799	730.3	6.3	0.89	305.6	28	2.67	e.	3.0	
	3,000		7.0			28		e.	5.6	
6.26	3,071	706.9	7.2	−0.33	309.4	28	2.84	e.	6.1	
	3,500		4.4			27		ese.	5.9	
6.30	3,795	646.6	2.5	0.65	312.1	27	1.97	se.	7.2	
	4,000		0.9			27		se.	8.0	
	4,500		−3.1			26		sse.	10.8	
6.36	4,703	577.2	−4.7	0.79	314.0	26	1.08	sse.	11.4	
	5,000		−5.1			25		sse.	10.4	
6.40	5,485	523.0	−5.8	0.14	321.6	24	0.90	se.	10.2	
	6,000		−10.1			23		se.	9.0	
6.44	6,278	472.5	−12.4	0.83	322.9	22	0.47	se.	8.6	
6.47	6,739	444.6	−14.9	0.54	325.4	22	0.37	se.	8.6	
	7,000		−17.5			22		se.	8.6	
	8,000		−27.3			22		s.	7.2	
6.56	8,042	373.3	−27.7	0.98	325.2	22	0.11	s.	7.4	
	9,000		−33.2					s.	2.1	
	10,000		−38.8					e.	4.0	
7.06	10,643	258.9	−42.5	0.57	339.2			se.	3.2	
	11,000		−44.2							
	12,000		−49.1							
	13,000		−53.9							
7.19	13,363	172.7	−55.7	0.49	359.1					
	14,000		−59.2							
	15,000		−64.7							
7.28	15,840	116.7	−69.3	0.55	376.5					Base of stratosphere.
	16,000		−69.0							
	17,000		−66.9							
7.33	17,182	94.2	−66.5	−0.21	405.8					
May 7, 1926, a. m.:										
7.06	225	990.5	22.1		295.9	70	18.63	se.	4.5	5/10 ci. and ci.-st., WSW.
	250		22.2					se.	4.8	
	500		23.3					e.	7.7	
7.08	565	952.6	23.6	−0.44	300.7			e.	8.2	
	750		22.2					e.	8.4	
	1,000		20.4					e.	7.8	
	1,250		18.5					e.	8.7	
	1,500		16.7					ene.	7.9	
7.14	1,702	834.8	15.2	0.74	303.5			ene.	6.9	
May 7, 1926, p. m.:										
1.06	225	988.2	29.6		303.6	31	12.87	se.	3.1	5/10 ci. and ci.-st., WSW.
	250		29.3					se.	3.2	
	500		26.5					se.	4.2	
	750		23.6					se.	4.4	
1.10	892	916.1	22.0	1.14	302.5			se.	4.5	
	1,000		21.0					se.	4.5	
	1,250		18.6					se.	4.6	
	1,500		16.2					se.	4.6	
	2,000		11.3					sse.	5.4	
1.14	2,056	799.1	10.8	0.96	302.6			sse.	5.3	
1.16	2,372	769.2	8.4	0.76	303.3			sse.	5.4	
	2,500		8.3					sse.	6.0	
1.18	2,692	740.0	8.2	0.06	306.5			s.	6.1	
	3,000		5.8					sse.	7.5	
	3,500		2.0					s.	7.0	
	4,000		−1.9					s.	7.9	
	4,500		−5.7							
1.34	4,627	582.2	−6.7	0.77	310.9					
	5,000		−7.3							
1.38	5,296	534.4	−7.8	0.16	317.2					
	6,000		−13.2							
	7,000		−21.0							
	8,000		−28.7							
1.58	8,179	364.4	−30.1	0.77	324.2					
	9,000		−35.1							
2.05	9,092	320.7	−35.6	0.60	328.7					
	10,000		−42.2							
	11,000		−49.5							
2.15	11,227	234.9	−51.1	0.73	335.8					
	12,000		−57.8							

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Potential temperature	Humidity		Wind		Remarks
						Relative	Vapor pressure	Direction	Velocity	
May 7, 1926, p. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
2.23	12.300	199.5	−60.4	0.87	337.1					Base of stratosphere.
2.25	12,751	186.3	−56.9	−0.78	349.4					
2.25½	12,798	184.8	−57.8	1.92	348.8					
6.20	225	985.4	22.0		296.2	35	9.26	e.	2.7	6/10 ci.-st., SW.
	250		22.4			34	9.22	e.	2.7	
6.21	410	964.7	25.3	−1.78	301.4	25	8.07	e.	2.8	
	500		24.5			25	7.69	e.	2.9	
	750		22.3			26	7.00	ese.	3.3	
	1,000		20.2			26	6.16	ese.	3.3	
	1,250		18 0			27	5.58	ese.	3.8	
	1,500		15.8			27	4.85	ese.	4.7	
	2,000		11.5			29	3.94	sse.	5.5	
	2,500		7.1			30	3.03	ssw.	3.3	
6.36	2,628	742.5	6.0	0.87	303.8	30	2.80	ssw.	3.1	
	3,000		3.7			30	2.39	s.	3.0	
	3,500		0.6			29	1.85	s.	5.2	
	4,000		−2.6			29	1.43	se.	9.5	
	4,500		−5.7			29	1,10	s.	10.5	
	5,000		−8.8			28	0.81	s.	9.2	
6.51	5,336	528.4	−10.9	0.62	314.6	28	0.68	s.	9.8	
	6,000		−14.7					se.	10.3	
	7,000		−20.5					sse.	3.7	
	8,000		−26.3							
7.11	8,878	328.6	−31.4	0.58	332.1					
	9,000		−32.2							
	10,000		−38.6							
7.17	10,029	279.3	−38.8	0.64	337.3					
7.21	10,863	247.4	−42.2	0.41	344.1					
	11,000		−43.2							
	12,000		−50.6							
	13,000		−57.9							
	14,000		−65.3							
7.39	14,444	143.2	−68.6	0.74	356.4					Base of stratosphere.
7.41	14,932	132.6	−64.1	−0.92	372.3					
	15,000		−63.8							
7.47	15,600	119.4	−61.5	−0.39	388.4					
May 8, 1926, a. m.:										
12.30	225	985.8	15.0		289.2	70	11.94	n.	0.9	3/10 ci. and ci.-st., S.?
	250		16.0							
12.31	358	970.6	20.2	−3.91	295.7					
	500		20.6							
12.33	671	936.0	21.0	−0.26	299.6					
	750		20.3							
	1,000		18.0							
	1,250		15.7							
	1,500		13.5							
	2,000		9.0							
	2,500		4.4							
12.46	2,821	723.4	1.5	0.91	301.1					
	3,000		0.3							
	3,500		−3.1							
	4,000		−6.4							
	4.500		−9.8							
12.57	4,517	583.8	−9.9	0.67	306.9					
	5,000		−12.6							
	6,000		−18.3							
1.08	6,334	459.8	−20.2	0.57	315.7					
	7,000		−24.9							
	8,000		−32.0							
	9,000		−39.1							
1.25	9,248	307.0	−40.9	0.71	325.4					
	10,000		−46.2							
	11,000		−53.2							
	12,000		−60.2							
1.45	12,719	181.3	−65.2	0.73	338.6					
6.45	225	984.8	15.8			90	16.16	ene.	2.7	2/10 ci. SE.
	250		16.0					ene.	2.4	
	500		18.4					se.	1.5	
6.48	[1] 723		20.6	−0.96				se.	2.1	
	750		20.4					se.	2.3	
	1,000		18.4					se.	3.3	
	1,250		16.5					se.	4.0	
	1,500		14.5					se.	3.8	
	2,000		10.6					se.	4.6	
6.59	[1] 2,425		7.2	0.79				sse.	4.4	
	2,500		6.5					ssw.	3.9	
	3,000		1.8					s.	5.3	
	3,500		−3.0					s.	5.8	
7.09	[1] 3,945		−7.2	0.95				s.	7.4	
	4,000		−7.5					s.	7.9	
	4,500		−10.3					s.	10.5	
	5,000		−13.0					sse.	8.8	
	6,000		−18.5					sse.	8.7	
7.24	[1] 6,361		−20.5	0.55				sse.	6.9	
	7,000		−24.0					sse.	11.4	
	8,000		−29.4					sse.	8.6	
	9,000		−34.9					sse.	8.0	
7.43	[1] 9,875		−39.7	0.55				sse.	7.6	
	10,000		−40.6					sse.	7.6	
	11,000		−48.2					ene.	7.0	

[1] Pressure element failed; altitudes taken from double-theodolite observation.

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	Δt/100 m.	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
	M.	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
May 8, 1926, a. m.:										
7.55	[1]11,775		−54.1	0.76				se.	3.1	
	12,000		−55.1					sse.	3.7	
7.59	[1]12,405		−57.0	0.46				sse.	4.9	Base of stratosphere.
8.02	[1]12,845		−57.9	0.20				sw.	5.6	
	13,000		−58.7					wsw.	7.0	
8.03	[1]13,050		−58.9	0.49				w.	7.2	
May 8, 1926, p. m.:										
6.20	225	981.0	20.9		295.5	70	17.31	ne.	1.8	6/10 A.-st., a.-cu., SSW., and 4/10 st.-nb., SW.
	250		21.3					ne.	2.2	
6.21	422	959.0	24.0	−1.57	300.6			ne.	4.8	
	500		23.4					ne.	6.0	
	750		21.5					ne.	4.5	
	1,000		19.7					nne.	3.9	
	1,250		17.8					n.	3.4	
	1,500		15.9					nw.	4.3	
6.26	1,754	821.4	14.0	0.75	303.6			wnw.	6.7	
	2,000		11.7					w.	9.0	
	2,500		7.1					wsw.	9.6	
6.30	2,823	722.0	4.2	0.92	304.3			sw.	9.4	
	3,000		2.9					sw.	9.3	
	3,500		−0.9					sw.	9.2	
	4,000		−4.7					ssw.	10.4	
6.39	4,373	594.7	−7.5	0.75	308.0			s.	10.8	
	4,500		−8.1					s.	9.0	
6.42	4,796	563.3	−9.5	0.47	310.5					
	5,000		−11.2							
	6,000		−19.6							
	7,000		−28.1							
6.53	7,352	400.5	−31.0	0.84	313.6					
	8,000		−38.7							
6.58	8,021	364.2	−38.9	1.18	312.5					
7.01	8,499	340.2	−41.8	0.61	314.7					
	9,000		−45.7							
7.05	9,288	303.2	−47.9	0.77	316.7					
May 9, 1926, p. m.:										
6.21	225	977.0	16.8		291.7	80	15.31	w.	4.5	10/10 A.-st., NW.
	250		16.7					w.	4.4	
	500		15.2					wnw.	3.8	
	750		13.8					w.	1.7	
	1,000		12.4					wsw.	1.5	
	1,250		11.0					sw.	3.6	
	1,500		9.6					sw.	5.9	
	2,000		6.7					sw.	4.7	
6.28	2,063	784.3	6.4	0.57	299.5			sw.	4.4	
	2,500		4.3					sw.	1.8	
6.30	2,651	730.0	3.6	0.48	302.6					
	3,000		0.8							
	3,500		−3.2							
6.35	3,728	638.0	−5.0	0.80	304.8					
	4,000		−6.1							
6.37	4,070	610.9	−6.4	0.41	307.0					
	4,500		−8.9							
	5,000		−11.8							
	6,000		−17.6							
6.48	6,589	439.3	−21.0	0.58	318.8					
	7,000		−23.8							
	8,000		−30.6							
	9,000		−37.4							
7.00	9,079	311.7	−37.9	0.68	328.1					
	10,000		−43.5							
	11,000		−49.5							
7.09	11,114	231.1	−50.2	0.61	338.7					
7.11	11,557	216.6	−53.5	0.75	340.0					Base of stratosphere.
	12,000		−53.4							
	13,000		−53.2							
7.17	13,747	155.1	−53.0	−0.02	374.9					
May 10, 1926, a. m.:										
7.03	225	976.6	11.7		286.6	60	8.25	e.	5.4	10/10 st., SSE.
	250		11.3					e.	6.0	
7.04	430	952.8	8.3	1.66	285.2			ese.	9.0	
	500		8.8					ese.	9.7	
7.05	715	920.6	10.3	−0.70	290.1			se.	10.0	
	750		10.0					se.	9.4	
7.06	982	891.6	8.3	0.72	290.7			sse.	5.4	
	1,000		8.4					s.	5.0	
7.06½	1,047	884.5	8.7	−0.62	291.3					
	1,250		7.7							
	1,500		6.5							
	2,000		4.1							
	2,500		1.7							
7.14	2,693	722.6	0.8	0.48	300.5					
	3,000		−0.2							
	3,500		−1.8							
	4,000		−3.4							
	4,500		−5.0							
	5,000		−6.6							
7.26	5,268	522.2	−7.5	0.32	319.7					
	6,000		−10.2							
7.38	6,790	428.6	−13.1	0.37	331.2					

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	Δt/100 m.	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
	M.	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
May 11, 1926, a. m.:										
6.25	225	988.2	6.7		280.7	85	8.34	ne.	4.5	Cloudless.
	250		6.4					ne.	5.0	
6.26	403	967.0	4.9	1.01	280.6			ne.	8.0	
6.26½	501	955.4	5.7	−0.82	282.4			e.	8.4	
	750		4.7					ene.	8.6	
6.29	927	907.0	4.0	0.40	284.8			ne.	10.8	
	1,000		4.7					ne.	10.8	
6.30	1,060	892.2	5.3	−0.98	287.5			ne.	11.0	
	1,250		4.7					ne.	12.0	
	1,500		4.0					ene.	9.2	
6.34	1,749	819.9	3.3	0.29	292.4			ne.	11.0	
	2,000		1.4					ne.	11.2	
6.37	2,183	776.9	0.1	0.74	293.5			ne.	14.2	
6.39	2,416	754.9	2.8	−1.16	298.9			ne.	11.4	
	2,500		2.3					ne.	10.6	
	3,000		−0.5					ne.	10.1	
	3,500		−3.3					n.	8.2	
	4,000		−6.1					n.	8.4	
6.48	4,066	613.7	−6.5	0.56	306.4			n.	9.2	
6.49	4,204	602.8	−5.8	−0.51	308.8			nne.	12.2	
	4,500		−7.4					ne.	12.8	
	5,000		−10.1					ne.	9.0	
	6,000		−15.5					ne.	13.6	
7.00	6,753	432.1	−19.6	0.54	322.1			ne.	13.6	
	7,000		−21.1					ne.	10.4	
	8,000		−27.1					ne.	14.6	
7.11	8,857	324.1	−32.3	0.60	332.2			ene.	11.8	
	9,000		−33.1					ne.	11.8	
	10,000		−38.9					ese.	6.0	
	11,000		−44.7					w.	15.6	
	12,000		−50.5					w.	17.0	
7.27	12,146	200.9	−51.3	0.58	350.8			w.	18.0	
7.30	12,526	189.6	−52.8	0.39	355.5			w.	[illegible]	
May 11, 1926, p. m.:										
5.43	225	986.8	16.0		290.1	45	8.19	n.	8.9	Few ci., E.
	250		15.6					n.	9.0	
	500		12.1					n.	9.4	
5.46	621	941.3	10.4	1.42	288.3			n.	8.4	
5.47	701	932.4	10.8	−0.50	289.5			n.	7.4	
	750		10.4					n.	6.8	
	1,000		8.6					nne.	5.8	
	1,250		6.8					ne.	5.8	
	1,500		5.0					ene.	6.7	
	2,000		1.3					ene.	7.9	
5.54	2,096	786.2	0.6	0.73	293.1			e.	7.9	
5.55	2,218	774.5	0.9	0.25	294.7			e.	8.3	
	2,500		0.8					e.	11.8	
5.57	2,587	739.8	0.8	0.03	298.4			ene.	14.0	
5.58	2,722	727.4	1.1	−0.22	300.2			ene.	13.9	
	3,000		−0.3					ene.	12.7	
	3,500		−2.8					ene.	15.0	
	4,000		−5.3					ene.	11.6	
6.07	4,139	608.8	−6.0	0.50	307.7			ene.	10.7	
	4,500		−8.3					ene.	10.2	
6.10	4,753	562.4	−9.9	0.64	310.2			ene.	7.4	
	5,000		−11.9					e.	7.2	
6.12	5,211	530.1	−13.7	0.83	310.9			e.	6.4	
	6,000		−20.6					e.	11.6	
	7,000		−29.3					e.	15.2	
6.25	7,352	396.6	−32.4	0.87	313.5			e.	17.7	
	8,000		−37.4					e.	12.2	
	9,000		−45.2					e.	10.5	
6.37	9,749	280.3	−51.0	0.78	319.4			se.	4.4	
	10,000		−52.5					e.	4.7	
	11,000		−58.5					e.	7.0	
6.46	11,543	212.8	−61.8	0.60	328.0			sw.	2.0	Base of stratosphere.
	12,000		−61.2					sw.	5.6	
6.50	12,136	193.6	−61.0	−0.13	339.1			sw.	6.6	
6.51	12,373	186.8	−59.1	−0.80	345.6			w.	8.1	
6.53	12,611	179.8	−58.7	−0.17	350.1			wsw	9.5	
6.54	12,901	172.1	−57.1	−0.55	357.1			w.	5.4	
	13,000		−56.3					w.	5.0	
6.56	13,085	167.5	−55.6	−0.82	362.4			w.	5.6	
May 12, 1926, a. m.:										
6.35	225	988.5	13.4		287.3	70	10.77	ese.	3.1	Few ci., ESE.
	250		13.2					ese.	3.3	
	500		11.5					ese.	6.0	
	750		9.8					ese.	5.8	
	1,000		8.1					ne.	5.5	
6.41	1,209	877.7	6.7	0.68	290.3			n.	5.0	
	1,250		6.4					n.	5.5	
	1,500		4.8					n.	7.5	
6.44	1,811	815.3	2.8	0.65	292.4			n.	6.3	
	2,000		2.3					n.	4.9	
6.49	2,498	748.7	0.9	0.28	297.5			n.	4.6	
6.50	2,726	727.9	1.5	−0.26	300.6			n.	3.7	
	3,000		0.0					n.	3.5	
	3,500		−2.8					n.	5.6	
6.57	3,969	622.8	−5.4	0.56	306.4			ene.	6.2	
	4,000		−5.5					ene.	6.2	

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	Δt/100 m.	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
May 12, 1926, a. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
6.57	4,500		−8.0					ene.	7.2	
	5,000		−10.4					ene.	8.0	
	6,000		−15.2					ene.	6.4	
	7,000		−20.0					e.	5.5	
7.13	7,293	402.9	−21.6	0.49	326.0			e.	8.4	
	8,000		−27.6					e.	7.3	
	9,000		−36.1					ese.	10.0	
7.28	9,884	280.3	−43.7	0.85	329.9			e.	11.8	
	10,000		−44.3					e.	12.0	
	11,000		−49.7							
7.38	11,958	205.7	−54.9	0.54	342.8					
May 12, 1926, p. m.:										
6.15	225	983.1	16.4		290.8	48	8.96	wnw.	2.7	Few ci.? very low on horizon, 5/10 a.-cu., WNW., and few cu., W.
	250		16.4					wnw.	2.9	
6.16	387	964.5	16.4	0.00	292.4			wnw.	3.8	
	500		14.8					wnw.	3.8	
6.18	543	947.0	14.2	1.41	291.7			wnw.	3.7	
	750		12.5					wnw.	3.6	
	1,000		10.5					wnw.	4.0	
	1,250		8.4					wnw.	4.9	
	1,500		6.4					wnw.	5.5	
	2,000		2.3					w.	5.9	
	2,500		−1.8					w.	6.8	
6.34	2,895	709.6	−5.0	0.82	295.6			wnw.	4.7	
6.35	2,982	701.5	−4.1	−1.03	297.6			wnw.	2.9	
	3,000		−4.2					wnw.	2.9	
	3,500		−7.1							
6.39	3,626	646.6	−7.8	0.58	300.4					
	4,000		−7.5							
6.43	4,081	610.0	−7.4	−0.09	305.9					
	4,500		−10.7							
	5,000		−14.6							
	6,000		−22.4							
6.58	6,380	450.3	−25.4	0.78	311.1					
	7,000		−30.3							
	8,000		−38.2							
	9,000		−46.1							
7.18	9,579	284.9	−50.6	0.79	318.5					
	10,000		−53.8							
7.26	10,982	229.8	−61.3	0.76	322.4					
	11,000		−61.4							
7.29	11,302	218.3	−63.0	0.53	324.5					Base of stratosphere.
	12,000		−61.6							
7.36	12,607	177.9	−60.4	−0.20	348.3					
May 13, 1926, p. m.:										
6.23	225	980.4	15.2		289.8	68	11.75	e.	4.0	5/10 a.-st., WSW. 3/10 Nb., WSW., and 2/10 st.-cu., WSW.
	250		15.3					e.	4.0	
6.25	492	950.0	15.8	−0.22	293.1			e.	2.8	
	500		15.7					e.	2.8	
	750		13.4					sse.	2.6	
6.28	948	900.1	11.6	0.92	293.3			s.	4.3	
	1,000		11.2					ssw.	4.7	
	1,250		9.2					ssw.	5.5	
	1,500		7.1					ssw.	6.7	
	2,000		3.1					sw.	8.9	
	2,500		−1.0					wsw.	8.5	
	3,000		−5.0					sw.	6.0	
6.46	3,442	660.7	−8.6	0.81	297.7			sw.	5.0	
	3,500		−8.9							
6.48	3,834	628.0	−10.9	0.59	299.4					
	4,000		−12.0							
	4,500		−15.3							
6.53	4,648	564.3	−16.3	0.66	302.3					
	5,000		−18.7							
	6,000		−25.6							
	7,000		−32.4							
7.06	7,419	386.2	−35.3	0.68	312.0					
	8,000		−39.7							
	9,000		−47.4							
7.23	9,849	270.4	−53.9	0.76	318.5					Base of stratosphere.
	10,000		−54.3							
	11,000		−56.8							
7.32	11,304	216.6	−57.6	0.25	333.6					
	12,000		−55.9							
7.39	12,407	182.7	−54.9	−0.24	354.6					
	13,000		−54.7							
7.44	13,105	163.8	−54.7	−0.03	366.2					
May 14, 1926, a. m.:										
6.27	225	982.1	12.8		287.3	94	13.89	n.	1.3	2/10 a.-st., W., and 8/10 Nb., W.
	250		12.3					n.	1.3	
6.27½	288	974.8	11.5	2.06	286.6			n.	1.4	
6.28	395	962.4	12.1	−0.56	288.2			nne.	1.6	
	500		10.9					ene.	2.0	
6.29	620	936.7	9.6	1.11	287.9			e.	2.6	
6.30	704	927.4	10.2	−0.71	289.4			se.	2.9	
	750		9.9					se.	3.0	
	1,000		8.4					sw.	3.6	
	1,250		6.9					wsw.	4.4	
	1,500		5.3					wsw.	4.6	
	2,000		2.3							
	2,500		−0.8							
	3,000		−3.8							
	3,500		−6.8							

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	Δt/100 m.	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
May 14, 1926, a. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
6.47	3,537	652.8	−7.1	0.61	299.5					
	4,000		−9.6							
	4,500		−12.4							
	5,000		−15.1							
	6,000		−20.6							
7.03	6,735	428.2	−24.6	0.55	316.6					
	7,000		−26.0							
	8,000		−31.5							
7.12	8,203	349.3	−32.6	0.55	324.8					
	9,000		−37.9							
	10,000		−44.4							
7.21	10,068	267.5	−44.9	0.66	332.6					Base of stratosphere.
7.23	10,705	243.4	−46.0	0.17	340.0					
	11,000		−46.8							
7.26	11,408	219.6	−47.8	0.26	347.4					
May 14, 1926, p. m.:										
5.30	225	985.1	15.1		289.3	75	12.88	w.	7.2	10/10 st., NW.
	250		14.9							
5.31	432	961.3	13.1	0.97	289.3					
	500		12.6							
	750		10.9							
	1,000		9.1							
5.38	1,238	872.7	7.4	0.71	291.5					
	1,250		7.3							
	1,500		5.6							
	2,000		2.1							
5.47	2,412	755.1	−0.7	0.69	295.1					
	2,500		−0.7							
5.49	2,616	736.2	−0.7	0.00	297.2					
	3,000		−3.0							
5.53	3,206	683.6	−4.3	0.61	299.6					
	3,500		−6.1							
5.58	3,785	635.0	−7.8	0.60	302.0					
	4,000		−7.9							
6.00	4,066	612.7	−7.9	0.04	305.0					
	4,500		−11.2							
	5,000		−14.9							
	6,000		−22.5							
6.16	6,327	454.3	−25.0	0.75	310.8					
	7,000		−33.2							
6.28	7,265	398.6	−36.4	1.22	307.8					
	8,000		−40.1							
6.36	8,878	315.8	−44.5	0.50	317.7					Base of stratosphere.
	9,000		−44.5							
	10,000		−44.5							
6.46	10,261	257.9	−44.5	0.00	336.7					
	11,000		−44.8							
6.55	11,453	216.5	−45.0	0.04	353.2					
May 15, 1926, a. m.:										
6.48	225	989.5	10.8		284.7	85	11.01	ne.	3.6	1/10 ci.-st., SW., and few a.-cu., NE.
	250		10.5					ne.	3.6	
6.49	482	959.2	7.3	1.36	283.7			nne.	4.5	
	500		7.2					nne.	4.5	
	750		6.0					nne.	6.9	
	1,000		4.6					ne.	6.2	
	1,250		3.5					nne.	6.9	
6.55	1,405	856.9	2.7	0.50	288.2			nne.	9.4	
	1,500		2.5					nne.	11.0	
6.59	1,990	797.1	1.7	0.17	293.1			ne.	12.4	
	2,000		1.6					ne.	12.4	
	2,500		−1.7					ne.	12.2	
	3,000		−5.1					nne.	9.6	
7.05	3,007	701.4	−5.1	0.67	296.5			nne.	9.6	
	3,500		−7.5					nne.	8.4	
	4,000		−10.0					nne.	11.6	
	4,500		−12.4					nne.	11.0	
7.15	5,005	542.1	−14.9	0.49	307.5			nne.	14.4	
	6,000		−21.5							
7.25	6,697	431.7	−26.2	0.67	313.8					
	7,000		−28.1							
	8,000		−34.4							
	9,000		−40.7							
7.39	9,994	270.3	−46.9	0.63	328.7					Base of stratosphere.
	10,000		−46.9							
7.43	10,798	239.3	−48.2	0.16	338.4					
	11,000		−49.1							
7.45	11,398	218.7	−50.8	0.43	343.2					
7.48	11,886	203.7	−49.0	−0.37	353.1					
May 15, 1926, p. m.:										
6.32	225	986.5	16.2		290.3	47	8.66	w.	3.1	Few ci. st., nne. 2 a.-cu., n.
	250		16.3					w.	3.6	
6.33	367	970.2	16.8	−0.42	292.3			w.	6.0	
	500		16.0					wnw.	7.5	
	750		14.4					nw.	9.8	
6.36	886	912.6	13.6	0.64	294.3			nw.	10.8	
	1,000		12.6					nw.	11.5	
	1,250		10.5					nw.	12.6	
	1,500		8.4					nnw.	12.8	
6.41	1,755	822.0	6.2	0.85	295.4			nnw.	13.5	
	2,000		4.2					nnw.	15.6	
6.44	2,432	756.3	0.6	0.83	296.5			n.	14.9	
	2,500		0.2					n.	14.9	
6.48	2,891	714.0	−2.2	0.61	298.4			nne.	17.9	

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100\ m.}$	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
	M.	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
May 15, 1926, p. m.:										
6.48	3,000		−2.8					nne.	18.1	
	3,500		−5.5							
6.55	3,911	627.4	−7.8	0.55	303.3					
6.56	4,003	620.1	−7.4	−0.43	304.8					
	4,500		−10.6							
	5,000		−13.8							
	6,000		−20.2							
7.07	6,024	475.9	−20.4	0.64	312.8					
	7,000		−27.5							
	8,000		−34.8							
7.19	8,246	350.1	−36.6	0.73	319.8					
	9,000		−42.0							
	10,000		−49.1							
7.28	10,210	262.6	−50.6	0.71	326.9					
	11,000		−53.7							
7.35	11,816	205.7	−56.9	0.39	340.8					Base of stratosphere.
	12,000		−57.0							
	13,000		−57.5							
7.41	13,068	169.8	−57.5	0.05	359.1					
May 16, 1926, p. m.:										
6.41	225	981.7	24.4		299.0	40	12.24	wsw.	4.9	3/10 ci. and ci.-st., nw., and 2/10 cu., wnw.
	250		24.8					wsw.	6.0	
6.42	266	977.2	25.0	−1.46	300.0			wsw.	7.8	
	500		24.0					w.	12.0	
6.44	641	936.1	23.4	0.43	302.0			w.	11.2	
	750		22.4					w.	8.3	
	1,000		20.0					w.	13.1	
	1,250		17.7					w.	15.6	
	1,500		15.3					w.	17.4	
6.53	1,777	819.8	12.7	0.94	302.4			wnw.	17.1	
	2,000		10.7					wnw.	16.3	
	2,500		6.1					wnw.	14.0	
	3,000		1.5							
7.05	3,310	679.9	−1.3	0.91	303.4					
7.06	3,438	669.2	−0.9	−0.31	305.2					
	3,500		−1.4							
	4,000		−5.1							
	4,500		−8.9							
	5,000		−12.7							
7.23	5,471	515.6	−16.2	0.75	310.4					
	6,000		−20.8							
	7,000		−29.4							
7.44	7,648	382.9	−35.0	0.86	313.2					
	8,000		−36.8							
7.52	8,694	330.3	−40.3	0.51	319.4					
	9,000		−43.1							
	10,000		−52.5							
8.05	10,616	247.7	−58.2	0.93	320.2					
May 18, 1926, p. m.:										
6.43	225	978.7	21.2		296.0	96	24.18	sw.	11.6	9/10 cu.-nb., WSW., and 1/10 st., SW.
	250		20.9							
	500		18.4							
	750		15.8							
6.48	820	913.2	15.1	1.03	295.7					
	1,000		14.6							
6.52	1,110	882.6	14.3	0.28	297.8					
	1,250		13.5							
	1,500		12.1							
	2,000		9.3							
6.58	2,138	780.8	8.5	0.56	302.1					
	2,500		5.8							
7.02	2,538	743.7	5.5	0.75	303.1					
	3,000		4.8							
7.07	3,164	689.1	4.5	0.16	308.7					
	3,500		3.3							
7.12	3,806	636.7	2.2	0.36	313.1					
	4,000		0.0							
7.16	4,212	605.2	−2.5	1.16	312.3					
	4,500		−4.4							
7.20	4,920	553.7	−7.2	0.66	314.4					
	5,000		−7.6							
7.22	5,217	533.1	−8.8	0.54	316.3					
	6,000		−13.8							
	7,000		−20.2							
7.33	7,401	400.0	−22.7	0.64	325.3					
	8,000		−26.7							
7.40	8,980	322.5	−33.3	0.67	331.3					
	9,000		−33.4							
	10,000		−40.2							
	11,000		−46.9							
	12,000		−53.7							
	13,000		−60.5							
	14,000		−67.1							
8.08	[1]14,552		−70.9	0.67						Base of stratosphere.
May 20, 1926, p. m.:										
6.08	225	985.4	17.0		291.2	40	7.75	sse.	3.1	4/10 ci. and ci.-st., WNW., and few a.-cu. and ci-cu.? very low on W. horizon.
6.09	250		17.2					sse.	4.0	
	338	972.4	17.9	−0.80	293.2			s.	6.3	
	500		16.5					s.	7.4	
	750		14.4					s.	8.8	
	1,000		12.2					s.	10.5	
	1,250		10.1					ssw.	11.0	
	1,500		7.9					wsw.	11.0	

[1] Altitude obtained from the ascensional rate.

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100\ m.}$	Potential temperature	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
	M.	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
May 20, 1926, p. m.:										
6.20	1,913	805.2	4.4	0.86	295.1			wsw.	12.2	
	2,000		4.8					wsw.	12.2	
6.21	2,099	786.9	5.3	−0.48	298.0			wsw.	11.1	
	2,500		2.9					w.	8.5	
	3,000		−0.2					w.	12.0	
	3,500		−3.2					w.	13.3	
	4,000		−6.2					wnw.	14.5	
6.36	4,013	619.8	−6.3	0.61	305.8			wnw.	14.5	
6.39	4,498	582.5	−7.8	0.31	309.5			w.	17.0	
	5,000		−11.9					w.	19.1	
6.44	5,305	524.5	−14.4	0.82	311.0			w.	19.9	
	6,000		−16.8							
6.53	6,447	451.1	−18.3	0.34	319.8					
	7,000		−22.7							
	8,000		−30.6							
	9,000		−38.6							
7.08	9,288	304.2	−40.9	0.79	326.2					
	10,000		−46.2							
	11,000		−53.7							
7.20	11,347	223.9	−56.3	0.75	332.5					
	12,000		−59.0							
	13,000		−63.2							
7.34	13,609	157.2	−65.7	0.42	351.9					Base of stratosphere.
	14,000		−62.5							
7.38	14,023	147.0	−62.3	−0.82	364.6					
May 21, 1926, p. m.:										
6.39	225	976.6	16.8		291.8	92	17.61	sse.	4.0	4 nb., SW.
	250		17.0					sse.	4.0	
6.40	405	956.2	18.3	−0.83	295.1			s.	11.3	
	500		17.7					ssw.	15.4	
	750		16.1					ssw.	22.3	
	1,000		14.5					ssw.	28.3	
	1,250		12.9					ssw.	30.6	
	1,500		11.3					ssw.	29.3	
	2,000		8.1							
	2,500		5.0							
6.53	2,655	730.6	3.9	0.64	302.9					
	3,000		2.1							
	3,500		−0.6							
	4,000		−3.3							
	4,500		−5.9							
	5,000		−8.6							
7.50	5,749	494.4	−12.6	0.53	318.5					
May 22, 1926, p. m.:										
6.37	225	991.9	9.4		283.1	70	8.25	nnw.	2.2	1/10 ci.-st., very low on N., W., and S. horizon.
	250		9.2					nnw.	2.4	
	500		7.5					nnw.	3.5	
	750		5.8					nnw.	5.3	
6.43	825	992.1	5.3	0.68	284.8			nnw.	6.7	
	1,000		3.9					nnw.	9.9	
	1,250		2.0					nnw.	13.3	
	1,500		0.1					nnw.	15.5	
6.52	1,765	820.8	−2.0	0.78	286.7			nnw.	16.8	
	2,000		−1.3					nnw.	16.0	
6.58	2,411	756.9	0.0	−0.31	295.6			nnw.	18.1	
	2,500		−0.8					nnw.	17.0	
	3,000		−5.1					nw.	15.6	
7.09	3,383	669.1	−8.4	0.86	296.8			nw.	19.6	
May 23, 1926, p. m.										
6.09	225	989.2	16.7		290.6	53	10.08	s.	3.1	Few cu.? along NE. horizon.
	250		16.5					s.	3.2	
	500		14.2					s.	10.0	
	750		12.0					ssw.	12.3	
	1,000		9.8					ssw.	15.1	
6.17	1,107	890.5	8.8	0.90	291.3			ssw.	13.6	
	1,250		9.8					sw.	13.9	
6.20	1,383	861.6	10.8	−0.72	296.1			wsw.	14.9	
	1,500		10.5					wsw.	15.9	
	2,000		9.2					w.	18.8	
	2,500		7.9					wnw.	18.6	
6.29	2,539	749.6	7.8	0.26	304.9			wnw.	18.5	
	3,000		3.8					wnw.	14.0	
	3,500		−0.5					nw.	20.1	
	4,000		−4.8					nw.	17.0	
6.47	4,410	593.2	−8.4	0.87	307.2					
	4,500		−9.1							
	5,000		−13.1							
7.00	5,595	508.0	−17.9	0.80	309.6					
	6,000		−20.9							
	7,000		−28.4							
	8,000		−36.0							
7.28	8,364	347.2	−38.7	0.75	317.1					
	9,000		−43.5							
8.05	9,868	278.5	−50.0	0.75	321.4					
May 24, 1926, p. m.:										
6.33	225	987.5	20.4		294.5	65	15.59	e.	4.9	1/10 ci.? very low on horizon.
	250		20.8					e.	4.9	1/10 a.-cu., WNW and 2/10 st.-cu., WNW.
6.34	272	982.2	21.1	−1.49	295.6			e.	5.5	
	500		20.5					e.	7.4	
	750		19.8					e.	3.6	
	1,000		19.2					wsw.	1.6	

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Potential temperature	Humidity		Wind		Remarks
						Relative	Vapor pressure	Direction	Velocity	
May 24, 1926, p. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
6.34	1,250		18.5					wnw.	5.0	
6.43	1,413	860.4	18.1	0.26	303.9			nw.	9.2	
	1,500		17.4					nw.	9.8	
	2,000		13.2					w.	12.4	
	2,500		9.0					wnw.	11.6	
6.55	2,860	724.0	6.0	0.84	306.0					
	3,000		5.1							
	3,500		2.1							
	4,000		−1.0							
	4,500		−4.0							
	5,000		−7.1							
7.19	5,767	502.5	−11.8	0.61	318.0					Clock stopped.
May 25, 1926, p. m.:										
6.25	225	985.8	24.0		298.2	87	25.98	ene.	6.3	4 a.-cu., WNW., and 4 cu., WSW.
	250		23.8					ene.	8.3	
6.27	468	958.8	22.4	0.66	299.0			e.	9.9	
	500		22.5					e.	8.4	
	750		23.1					s.	2.4	
6.30	871	915.5	23.4	−0.25	304.0			sw.	3.6	
	1,000		22.6					wsw.	5.5	
	1,250		21.0					w.	8.0	
	1,500		19.4					w.	9.8	
	2,000		16.1					wsw.	11.8	
6.41	2,185	786.0	14.9	0.65	308.4			w.	12.5	
	2,500		11.1					w.	12.2	
6.48	2,981	714.3	5.2	1.22	306.3			w.	13.0	
	3,000		5.1					w.	13.0	
	3,500		3.5							
6.54	3,668	657.0	3.0	0.32	311.2					
	4,000		0.3							
	4,500		−3.6							
7.02	4,657	581.1	−4.9	0.80	313.1					
	5,000		−6.6							
7.13	5,840	499.5	−10.7	0.49	319.9					
	6,000		−11.9							
	7,000		−19.5							
	8,000		−27.1							
	9,000		−34.7							
7.45	9,036	325.1	−35.0	0.76	328.2					
	10,000		−42.2							
	11,000		−49.7							
8.16	11,059	242.7	−50.3	0.76	333.9					
May 26, 1926, p. m.:										
6.20	225	987.5	16.0		290.0	99	18.01	ene.	8.5	10/10 st., ENE.
	250		15.5							
	500		10.8							
6.24	558	949.1	9.7	1.89	287.0					
6.25	683	935.1	14.5	−3.84	293.1					
	750		14.5							
	1,000		14.6							
	1,250		14.7							
	1,500		14.8							
6.35	1,733	826.2	14.9	−0.04	304.1					
	2,000		13.1							
	2,500		9.7							
6.43	2,773	729.5	7.8	0.68	307.3					
	3,000		5.9							
	3,500		1.6							
	4,000		−2.6							
7.01	4,306	603.2	−5.2	0.85	309.5					
										Pressure element failed hereafter.
May 27, 1926, p. m.:										
5.53	225	993.2	21.8		295.4	57	14.90	ene.	6.3	2/10 ci.-st., N.
	250		21.6					ene.	6.3	
	500		19.7					e.	8.9	
	750		17.7					e.	12.0	
	1,000		15.8					e.	12.0	
6.00	1,052	902.0	15.4	0.77	297.0			e.	12.4	
	1,250		14.8					e.	13.1	
	1,500		14.2					e.	12.4	
	2,000		12.8					e.	6.7	
	2,500		11.4					ene.	3.4	
6.16	2,882	725.3	10.3	0.28	310.6			nnw.	2.9	
	3,000		9.7					nnw.	2.8	
	3,500		7.0					ene.	2.6	
	4,000		4.3					nne.	2.0	
	4,500		1.6					ene.	2.3	
	5,000		−1.1					ene.	4.0	
6.38	5,192	546.4	−2.1	0.54	322.0			ne.	3.3	
	6,000		−7.6					n.	3.4	
6.47	6,231	478.9	−9.2	0.68	325.6			nnw.	2.9	
6.54	6,907	438.8	−12.7	0.52	329.4			nne.	9.0	
	7,000		−13.5					nne.	7.5	
	8,000		−21.8							
	9,000		−30.2							
7.17	9,437	311.8	−33.8	0.83	333.8					
	10,000		−38.0							
	11,000		−45.3							
7.32	11,252	240.6	−47.2	0.74	339.4					
	12,000		−53.0							
7.46	12,978	185.6	−60.5	0.77	344.0					

TABLE 8.—*Free-air data by sounding balloons, Royal Center, Ind., May, 1926*—Continued

Time	Altitude	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Potential temperature	Humidity		Wind		Remarks
						Relative	Vapor pressure	Direction	Velocity	
May 28, 1926, p. m.:	*M.*	*Mb.*	*° C.*		*° A.*	*Per cent*	*Mb.*		*M. p. s.*	
6.27	225	994.9	19.9		293.3	57	13.25	e.	2.7	3/10 a.-cu., NNW.
	250		19.7					e.	4.0	
	500		17.8					e.	7.6	
	750		15.8					e.	7.4	
	1,000		13.9					ese.	6.5	
6.38	1,187	888.6	12.4	0.78	295.2			ese.	6.4	
	1,250		12.5					se.	5.3	
6.42	1,498	856.2	12.9	−0.16	298.9			sse.	1.8	
6.45	1,812	824.7	11.0	0.61	300.1			s.	3.6	
	2,000		11.6					sw.	3.7	
6.48	2,075	798.4	11.9	−0.34	303.8			wsw.	3.0	
	2,500		9.2					nw.	2.9	
	3,000		6.1					wnw.	1.8	
	3,500		2.9					se.	1.3	
7.05	3,517	671.0	2.8	0.63	309.1			se.	1.3	
	4,000		−0.3					se.	3.1	
	4,500		−3.4					ene.	2.5	
	5,000		−6.6					nne.	2.7	
7.25	5,315	535.1	−8.6	0.64	316.2			nne.	4.0	
	6,000		−13.1					n.	4.5	
	7,000		−19.7							
7.45	7,132	421.9	−20.6	0.66	323.1					
	8,000		−26.4							
	9,000		−33.1							
8.08	9,086	322.7	−33.7	0.67	330.7					
	10,000		−40.1							
8.24	10,600	259.9	−44.3	0.70	336.2					
	11,000		−47.5							
8.33	11,433	229.5	−50.9	0.79	338.4					
May 29, 1926, p. m.:										
5.59	225	990.9	24.4		298.2	56		se.	2.7	1/10 a.-st.? Very low on E. horizon.
	250		24.5					se.	2.8	
6.01	460	964.7	25.1	−0.30	301.2			sse.	5.4	
	500		24.8					sse.	5.5	
	750		22.8					sse.	6.0	
	1,000		20.9					sse.	6.9	
	1,250		18.9					s.	7.4	
6.11	1,300	875.8	18.5	0.79	302.8			s.	7.1	
	1,500		17.8					s.	4.0	
6.17	1,748	831.0	17.0	0.34	305.8			wnw.	3.3	
	2,000		15.3					nw.	4.1	
	2,500		11.9					nw.	5.4	
	3,000		8.5					wnw.	5.6	
6.39	3,106	707.0	7.8	0.68	310.1			wnw.	6.1	
	3,500		4.8					w.	5.9	
	4,000		1.1					w.	5.6	
6.58	4,201	618.0	−0.4	0.75	312.8			w.	7.8	
May 30, 1926, p. m.:										
6.25	225	987.1	26.8		300.9	69	24.34	ssw.	2.7	1/10 ci.-st., very low on S. horizon.
	250		26.6					ssw.	3.2	1/10 cu.-nb., W., and 6/10 st.-cu., WSW.
	500		24.5					sw.	7.7	
	750		22.4					sw.	7.0	
	1,000		20.3					wsw.	7.9	
6.35	1,169	886.0	18.8	0.85	302.1			wsw.	8.3	
	1,250		18.2					wsw.	8.7	
	1,500		16.4					wsw.	9.6	
	2,000		12.7							
6.48	2,339	771.6	10.2	0.74	305.0					
	2,500		9.5							
	3,000		7.2							
	3,500		5.0							
7.06	3,986	631.6	2.8	0.45	314.5					
	4,000		2.7							
	4,500		−0.4							
	5,000		−3.5							
7.20	5,139	547.2	−4.4	0.62	319.2					
	6,000		−10.0							
	7,000		−16.4							
7.48	7,742	390.3	−21.2	0.65	329.5					
	8,000		−23.4							
	9,000		−31.7							
8.11	9,679	299.2	−37.4	0.84	332.7					
	10,000		−40.2							
	11,000		−48.8							
8.54	11,216	239.2	−50.6	0.86	334.8					
May 31, 1926, p. m.:										
6.23	225	979.0	23.8		298.6	94	27.74	ssw.	8.5	10/10 st., SW.
	250		23.4							
6.24	382	961.6	21.5	1.47	297.8					
	500		20.4							
	750		18.0							
6.27	898	905.6	16.6	0.95	297.9					
	1,000		16.8							
6.28	1,013	893.7	16.8	−0.17	299.3					
	1,250		15.5							
	1,500		14.1							
6.32	1,934	801.5	11.7	0.55	303.3					